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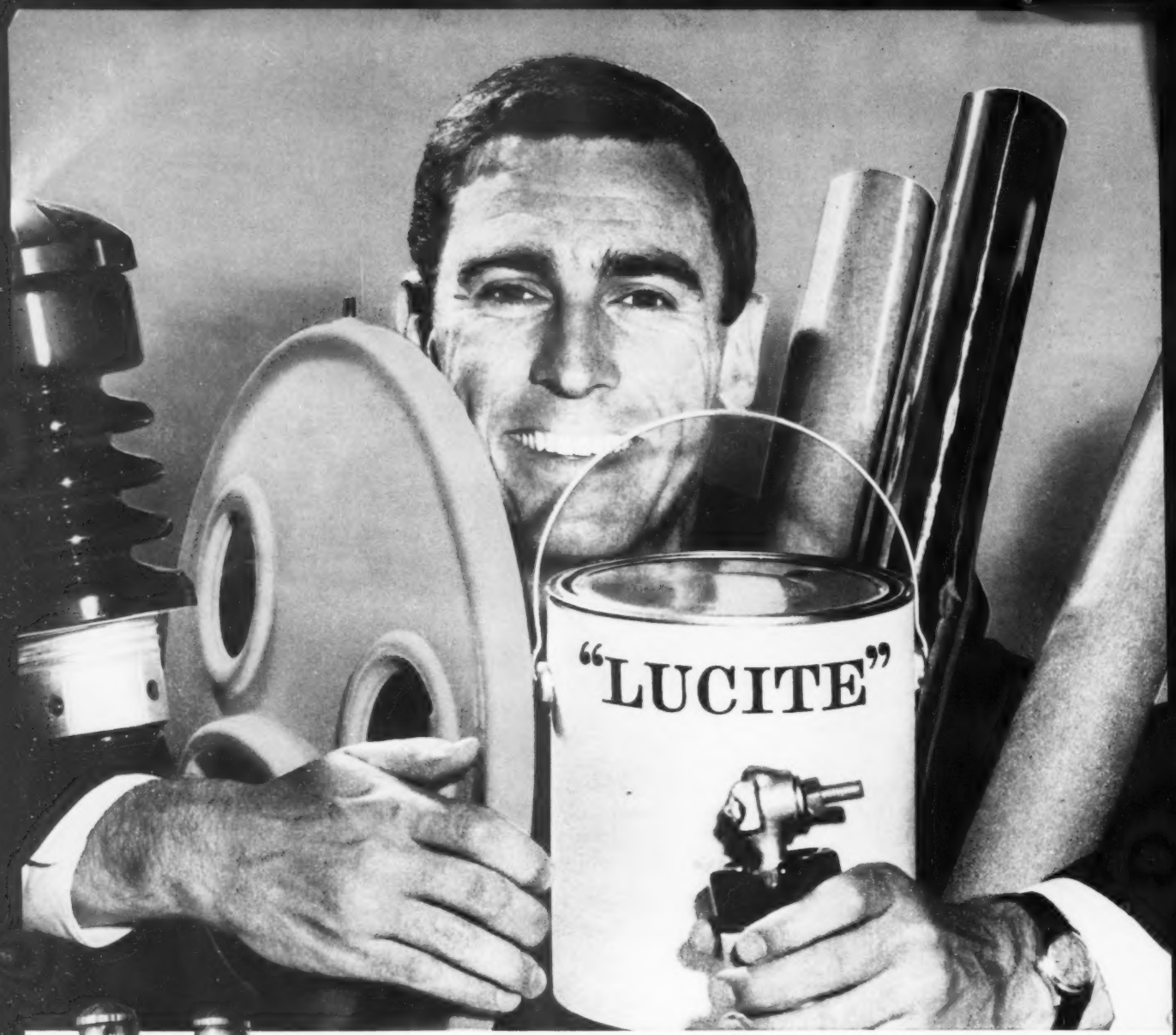
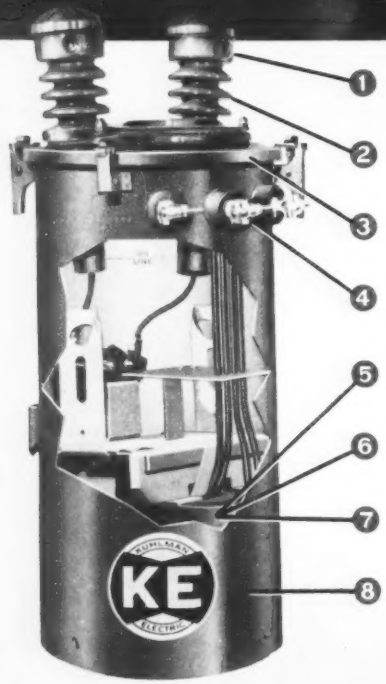
ELECTROLUMINESCENCE

Your New Frontier in Light





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ONLY KUHLMAN TRANSFORMERS GIVE YOU ALL THESE EXTRAS AT NO EXTRA COST...

1 "Quick-Grip" connectors **2** sleeve-type bushings **3** Celuclad covers **4** low voltage connectors for copper or aluminum conductors **5** SPI-65* super insulation **6** shielded primaries **7** extra end-turn insulation **8** "Lucite" all-weather finish. Your local Kuhlman representative has all the facts. Call him today and find out about all the exclusive features offered this year by Kuhlman.

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KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Michigan

Manufacturers of transformers since 1894

Western Division—Salinas, California

1,000,000,001 TAXES

"The power to tax is the power to destroy"

CHIEF JUSTICE MARSHALL 1819

Back in 1819, Chief Justice Marshall made the statement that the power to tax involves the power to destroy. Many economists think that it is high time to take a good look at our tax structure in this country because we may be perilously close to the time when the destructive effects of excess taxation come into play.

We, as citizens of a democracy, are given the power to tax ourselves and thus the latent power to literally destroy our system of individual enterprise. We elect the law makers who can enact the tax laws. These politicians in turn find it easy to support programs that will increase their popularity with the voters. In turn, these programs cost money and the money must be provided from the only source of income that the government has; namely, taxes.

No one can deny that taxes are necessary to support essential functions of government. It is when we go beyond the essential functions of government that the real dangers of excessive taxation begin to appear.

Just how far have we gone in this matter of paying taxes? It may surprise you to know that, as an average employee of a corporation, you work 2 hours and 40 minutes each day neither for the company nor yourself—just to earn enough to pay your tax bill. One-third of all we earn as individuals goes to the tax collector. More than one-half of the earnings of the company we work for goes to the tax collector directly—and the company acts as the tax-collecting agent for a substantial percentage of the money it takes in for such things as social security, unemployment and a host of other business "expenses" that in reality are various forms of taxes imposed to support the many welfare programs and obtain other needed revenue to support the various levels of government.

As individuals, our "take home" pay is only about three-fourths of our actual earnings. The other quarter has been deducted for the tax collector. But this is only the beginning of our individual tax contribution. When we start spending our take-home pay, another big bite is deducted in the form of direct and hidden taxes that mount up to nearly $100 a month for the average citizen. Most states have a 3 or 4% sales tax. We can see that. But how many housewives know that they are paying 151 hidden taxes whenever they buy a loaf of bread and that these taxes double the price?

Many service stations post the price of gasoline as 19.9c per gallon plus 10c tax so that you will know that one-third of the price you pay for gasoline is a direct tax contribution. The hidden taxes on that gallon of gasoline paid by the producer, refiner and distributor are as much or more than the 10c imposed directly on the sale of each gallon.

If you buy a new compact car, the hidden prices included in the showroom price are over $300. The Tax Foundation has estimated that there are 116 hidden taxes in the suit of clothes that you buy and that the mortgage that you sign for your new house includes 600 hidden taxes.

All this adds up to the fact that we are now paying more than one-third of our national income to the tax collector and our law makers keep on enacting new and ingenious laws to extract still more dollars from our individual pocketbooks and the tills of the companies we work for. Already this high taxation is destroying one of our most priceless ingredients in the individual enterprise system — initiative. "Why work hard to get ahead? Why start a new business when the tax collector is standing by waiting to pick up half of all your earnings?"

We, as employees, have the greatest stake of all in keeping the tax take within bounds. We, as good citizens and voters, can stop the drift toward bigger pork barrels, give-away schemes and unneeded and unnecessary programs aimed at pampering minorities and winning votes. Every time we let the government provide a new service for us, we ask that a bigger bite be taken out of our earnings. Every time we add to the tax burden we reduce the opportunities for economic growth and expansion and the areas for individual freedom.

In just 30 years the cost of running the federal government has jumped 30-fold, from $3 billion a year to $90 billion a year. If that rate of growth should continue for just another decade, the tax collector will have all our pay check instead of just one-third—and the Golden Age of Freedom will have passed.

"I get the message"

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Cover: Electroluminescent moods created by the new flat light sources offer designers new opportunities with a flexible medium and the industry with an expanded frontier in light. Photo by Sylvania Electric Products.

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Electrical West (with which is consolidated The Journal of Electricity), October 1961, Vol. 127, No. 4. Published semimonthly except June and November when published trimonthly by McGraw-Hill Co. of California, James H. McGraw 1860-1948) Founder. Office of publication, 235 N.W. Park Ave., Portland 9, Ore. See panel below for directions regarding subscriptions or change of address.

Executive, editorial, circulation and advertising offices: 255 California St., San Francisco 11, Calif. Donald C. McGraw, chairman of the board; George C. Tenney, president; John W. Otterson, vice-president; Thomas H. Carmody, secretary and treasurer.

Position and company connection must be indicated on subscription orders. Send to address shown in panel below. Subscription price includes the regular monthly issue, the news letter issue and the November directory issue. United States subscription rate $3 a year, single copies 50c. (November directory issue $1); Latin American Republics and Philippine Islands $6 a year; Canada $4 a year; all other countries $10 a year. Entered as second class matter, Dec. 17, 1956, at the post office at Portland, Ore., under the act of March 3, 1879. Printed in U. S. A. Title registered in U. S. Patent Office.

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This symbol stands for fusible switch

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THE SAFETY SWITCH THAT CHALLENGES COMPARISON!

BullDog's general-duty safety switch – a star performer indoors and out!

All BullDog general-duty safety switches, in either indoor or raintight enclosures, combine these outstanding features for maximum safety and dependability:

- Minimum arcing—double-break switching
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. . . Plus, all current-carrying parts are silvered. And with BullDog, you sell a complete line, competitively priced, that fills all over-the-counter calls for general-duty safety switches. The switches are available in both NEMA 1 and NEMA 3R enclosures. Challenge our field representative to prove these switches are the finest . . . or write BullDog for details.

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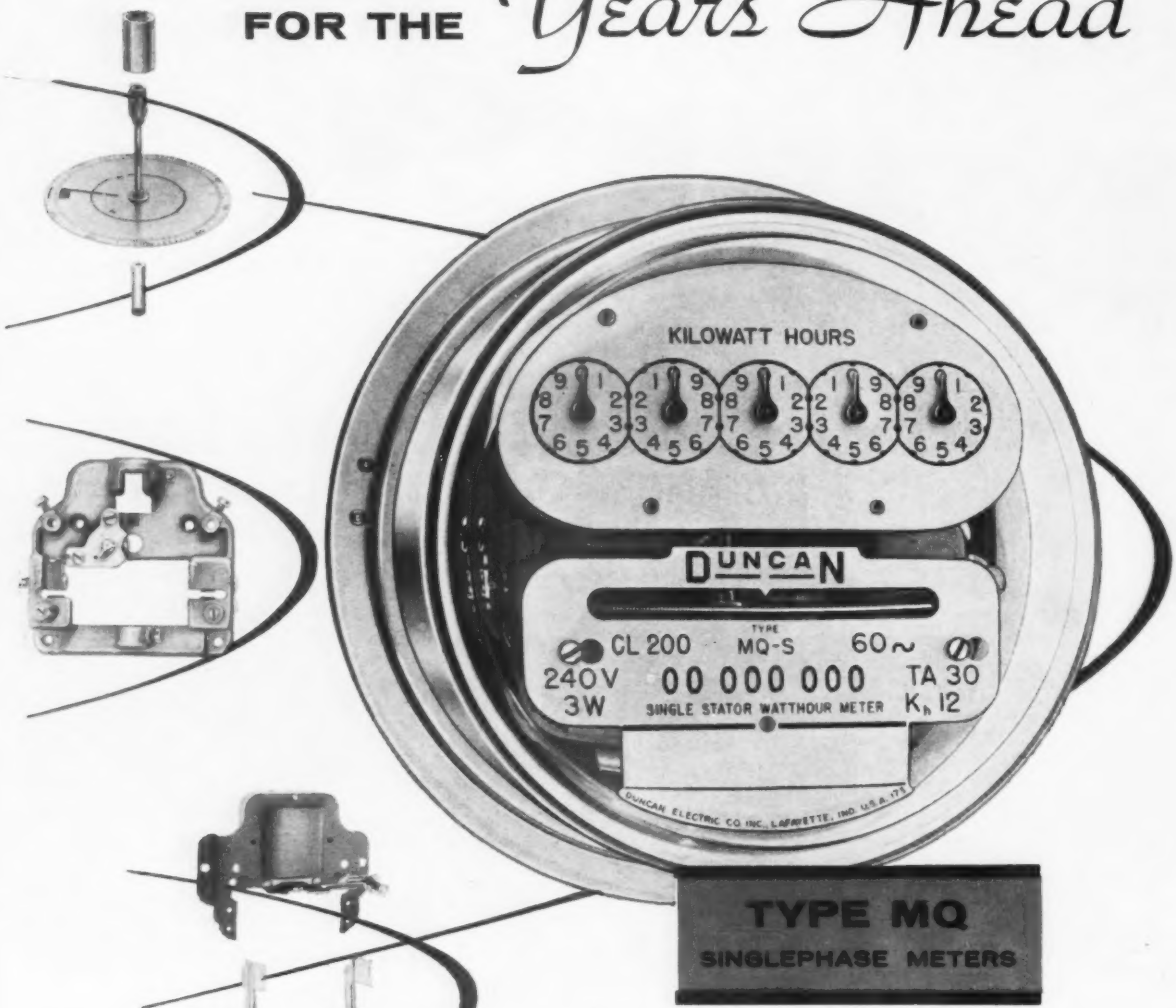
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3W SINGLE STATOR WATTHOUR METER Kh 12
DUNCAN ELECTRIC CO. INC., LAFAYETTE, IND. U.S.A.

TYPE MQ
SINGLEPHASE METERS

Building a *truly better* watthour meter is a goal that might seem impossible in accomplishment when compared with standards already attained. With careful deliberation and decision, Duncan has achieved this end in the TYPE MQ meter, now in full production in all Classes—10, 100 and 200.

The meter incorporates Duncan's shielded top magnetic bearing. The new design also provides for front removal of the rotor through new positioning of high energy, surge-resistant Alnico damping magnets. Positive end play control of rotor . . . separable electromagnets . . . simplified assembly and adjustment are "user approved" features. *Let us give you the complete story.*

DUNCAN
ELECTRIC CO., INC.
LAFAYETTE, INDIANA

"Thinking Ahead . . . Moving Ahead
. . . to stay Ahead of Demand"

WATTHOUR METERS MOUNTING DEVICES DEMAND METERS

For phone number of closest representative see advertising index in back of book.

Another shopping area made safe and enjoyable with

WELD-RITE LIGHTING STANDARDS

When Safeway opened its Tahoe City Center early in 1960, Weld-Rite standards were selected to light the parking area. Safeway is a long-time user of Weld-Rite standards, as well as a strong believer in the power of good lighting to attract customers and to improve parking convenience and safety.

Designs, sizes for any need

You, too, will find Weld-Rite standards are strong, weather resistant, long lasting. They're die-formed from full 10-gauge steel, and dip painted inside and out. They're made in many slim, graceful designs for parking lots, recreational facilities, streets, highways, and all areas requiring flood lighting for safety and security. Sizes: 10' and up. All meet EEI-NEMA specifications.

Quick delivery from Western plant

Anchor bolts and templates first, then poles exactly when requested. Compare Weld-Rite with any other lighting standard for gauge, stiffness, load-carrying ability, ease of erection, weather resistance, beauty of design, delivery and price.

Yours for the asking—28-page Bulletin No. 7, "Steel Lighting Standards;" 12-page Bulletin No. 6, "Flood Lighting Poles." Write or phone today.

11

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Only active manufacturer of round tapered steel poles in the West

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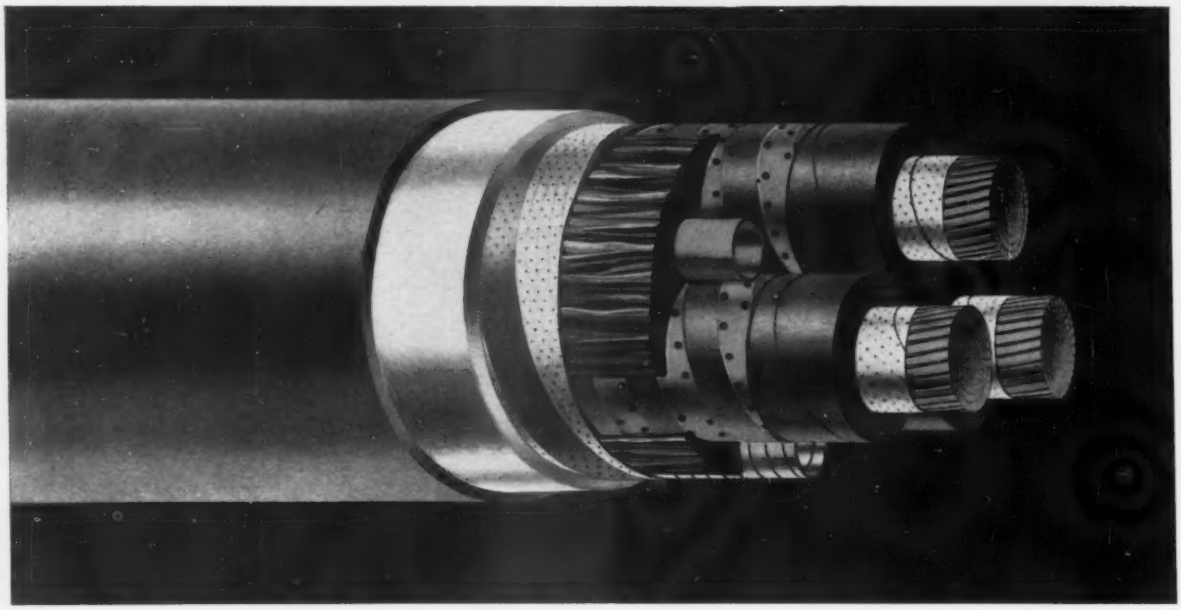
DEVELOPED BY PHELPS DODGE FOR THE ELECTRIC UTILITY INDUSTRY

New 69 KV High-Pressure, Gas-Filled Aluminum Sheath Aerial Cable

Provides Practical, Economical Design for Increasing Transmission Requirements in Congested Areas



CABLE SPECIFICATION

Voltage	69 Kv.
Rating	75 MVA
Ambient air temperature	25°C
Conductor temperature, normal	75°C
emergency	90°C
Nominal shipping length	1000 ft.
Cable construction	
Three compact round conductors	800 MCM
Graded 1 to 6 mil wood pulp paper insulation	315 mils
Two steel spiral gas channels O.D.	0.760″
One copper tube gas channel O.D.	0.625″
Seamless tubular aluminum sheath	180 mils
Extruded high density polyethylene jacket	125 mils
Overall diameter	4.15 in.
Nominal operating pressure	200 psig.
Joints	Mechanical
Potheads	HPG type
Gas supply	Central Gas Cabinet

TESTING SPECIFICATION

Power factor at 90°C	below 1.0%
Ionization factor	Minimum
Sixty cycle voltage tests to ground	
Full reel	47 Kv.
Sample withstand tests,	
6 hour	107 Kv.
one minute	175 Kv.
Impulse withstand voltage test to ground (1½ x 40)	
Cable and splice	350 Kv.
Load cycle test, 60 Kv. to ground, 100°C copper	Stable

Cable was installed using aluminum blocks supplemented by periodic placement of steel blocks for mechanical strength, 69 KV cable was pulled into position from reel on trailer to messenger.

Phelps Dodge has designed and fabricated a versatile new three-conductor 69 KV aerial cable system for Long Island Lighting Co. specifically engineered for its rapidly growing suburban areas. This aluminum sheathed paper insulated high voltage power cable may be installed on distribution poles and offers the advantage of aerial cable performance at a cost substantially lower than equivalent underground cable systems. In communities with steady population and industrial growth, it meets a current need for transmitting increased electric power at high voltages where open wire systems cannot be installed.

The entire circuit includes 10,000 feet of aerially installed cable and 3000 feet of directly buried underground cable. All directly buried underground cable was provided with a high density polyethylene jacket for both mechanical and corrosion protection. Mechanical joint sleeves, developed and introduced by Phelps Dodge for use with aluminum-sheathed cable, together with installation techniques that assure dependable cable performance, were used in this LILCO project.

Other features of this advanced aerial cable are its relatively light weight and small diameter for its voltage and rating. A simple pressure control system maintains the nitrogen gas at a nominal 200-pound pressure.

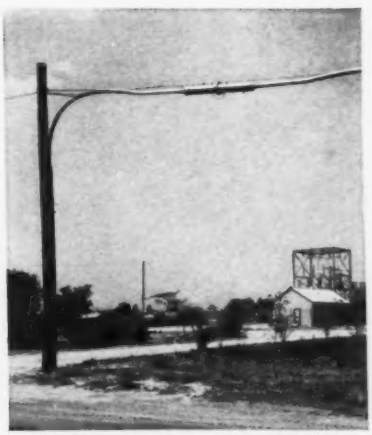
The first aluminum sheathed aerial power cable installed in the United States was designed and fabricated by Phelps Dodge in 1953. Over the past years, this type cable has gained increased acceptance with utilities as an economical and practical answer to special transmission problems.

Pressurized aluminum sheathed aerial cable was first installed in this country in 1957. During that same year, design was begun on the cable system which is described here. Phelps Dodge can furnish aluminum sheathed power cable systems within a wide range of higher voltage ratings, and has designed and fabricated a 345 KV cable of this type with a capacity of 500 MVA.

For further information and engineering assistance on your particular problems, contact your local Phelps Dodge representative.

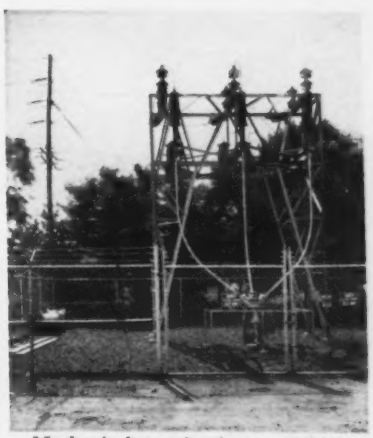
Underground portion of cable is shown in trench for direct burial. A section of underground portion was drawn thru a steel sleeve which had been driven under a heavily traveled parkway. An extruded high density polyethylene sheath was applied over aluminum sheath for mechanical and corrosion protection of underground sections.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N.Y.



Underground section of cable emerges from ground in a specially designed ventilated riser, spliced to aerial section. Note neat appearance of cable, including normal joint.

At local intersection, 69 KV cable shares poles with telephone cables, secondary and 13 KV primary. Use of aluminum sheath aerial cable overcomes objections to overhead open wire systems in communities.



Mechanical termination assembly showing both aerial and underground terminations of cable system. Termination assembly, an above ground spreader type, is fabricated completely of aluminum.

For phone number of closest representative see advertising index in back of book.

Now 2 sizes of
UNOREG

Save 50% and more on voltage re-regulation

Now Westinghouse UNOREG* can handle 81% of all voltage re-regulation on secondary distribution systems—at savings up to 60%. The introduction of a new 2½ KVA UNOREG extends the benefits of this lowest cost regulating system to cover a total of 8 standard ratings in over 600 transformer styles.

This unique Westinghouse voltage regulator brings immediate relief to secondary distribution problems, offers a new concept in systems design and voltage regulation and provides sound re-regulation under emergency conditions.

UNOREG works on an induction principle with two sets of coils: a rotor and a stator. A solid state control meters the input voltage, actuates the rotor which raises or lowers the output voltage automatically. Its operation is maintenance-free and completely reliable. Contact your Westinghouse sales engineer to learn how other electric utilities are reducing operating costs with UNOREG. Or, write: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's Westinghouse.*

The 1¼ KVA UNOREG is available to handle transformer ratings up to 25 KVA and the 2½ KVA model handles ratings up to 50 KVA. Color-coded for easy connection. Tank-mounting bracket has standard 12" bolt hole spacing for pole mounting.

*Trade-Mark

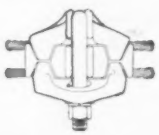
J-70978

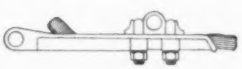
Westinghouse

10 TIMES ACROSS THE CONTINENT

SINCE 1954, Bethea Company has made and shipped aluminum alloy suspension clamps to string over 26,500 miles of three phase, high voltage transmission line, using conductors that average 795,000 CM — enough to stretch across the continent ten times. Dead ends sold with these clamps would extend the line another 6,000 miles.

Bethea clamps did — and are doing — the job. You can count on Bethea's high quality. Bethea's ultimate strengths are the highest in the industry, yet cost no more.





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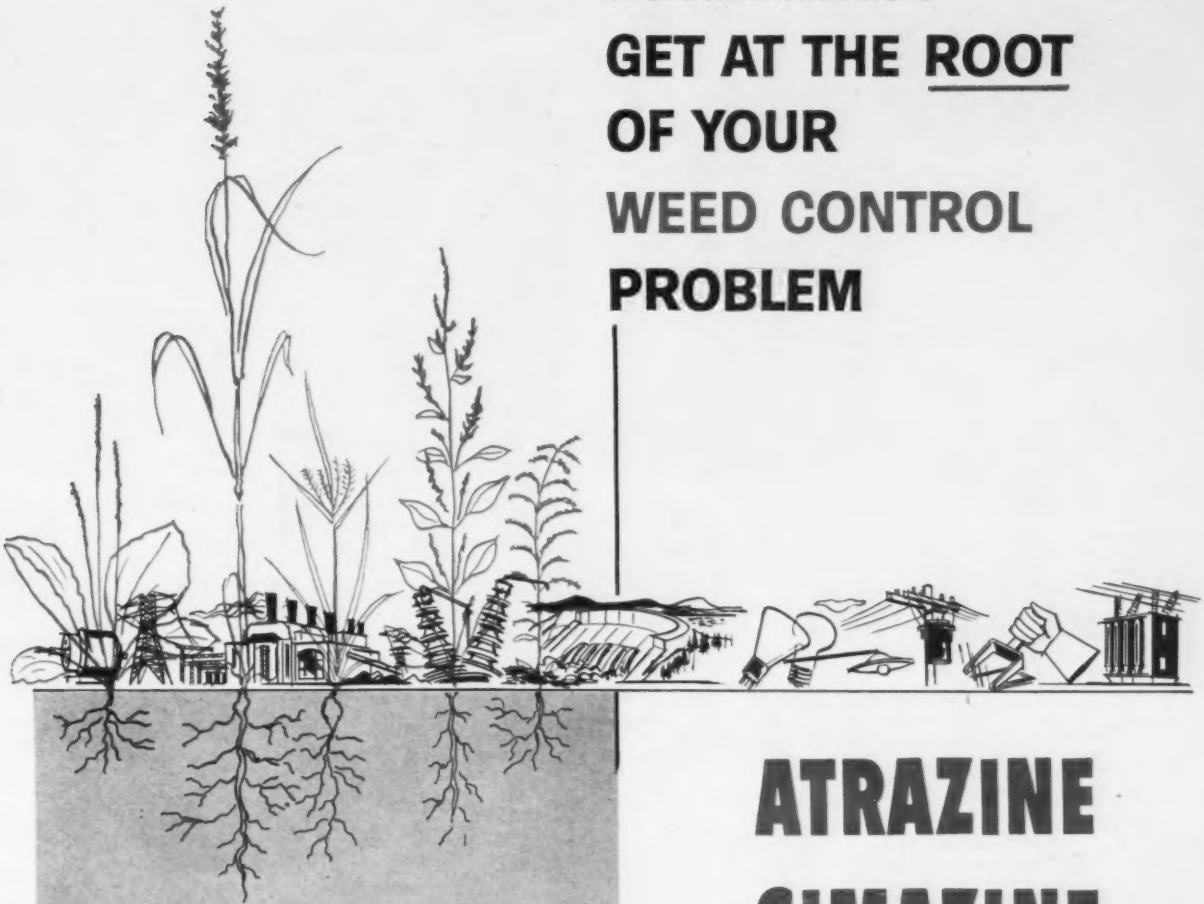
GET AT THE ROOT OF YOUR WEED CONTROL PROBLEM



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SIMAZINE

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Geigy industrial herbicides make possible full season weed control from one application.

Atrazine or Simazine controls both broadleaf weeds and grasses—are non-irritating and low in toxicity to humans and animals. Both provide ease and economy in use.

Plan now to get at the root of your weed control problem. Your supplier has Geigy industrial herbicides in wettable powder or granular form. For free information call him today or write—Geigy Agricultural Chemicals, Division of Geigy Chemical Corporation, Saw Mill River Road, Ardsley, New York.

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Keep your fleet ready for any service call, with all the supplies it needs –from hardware to wire and conduit. But don't tie up capital in do-it-yourself warehousing! Let your Graybar service center be your warehouse for service fleet supplies, as well as everything else electrical. ■ Prompt? We process your order the day we get it. And with your help–we can often deliver on the same day, too. Here's how: we work

out with you a planned purchase program, in which we stock what you need at our expense—even if your requirements are unusual. Your own inventory is minimum, yet you get what you want when and where you need it. ■ So don't pay the cost of possession that's the penalty of an unbalanced inventory. See Graybar—for everything. Graybar Electric Co., Inc.: local service to utilities through coast-to-coast warehousing.

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ALLIS-CHALMERS

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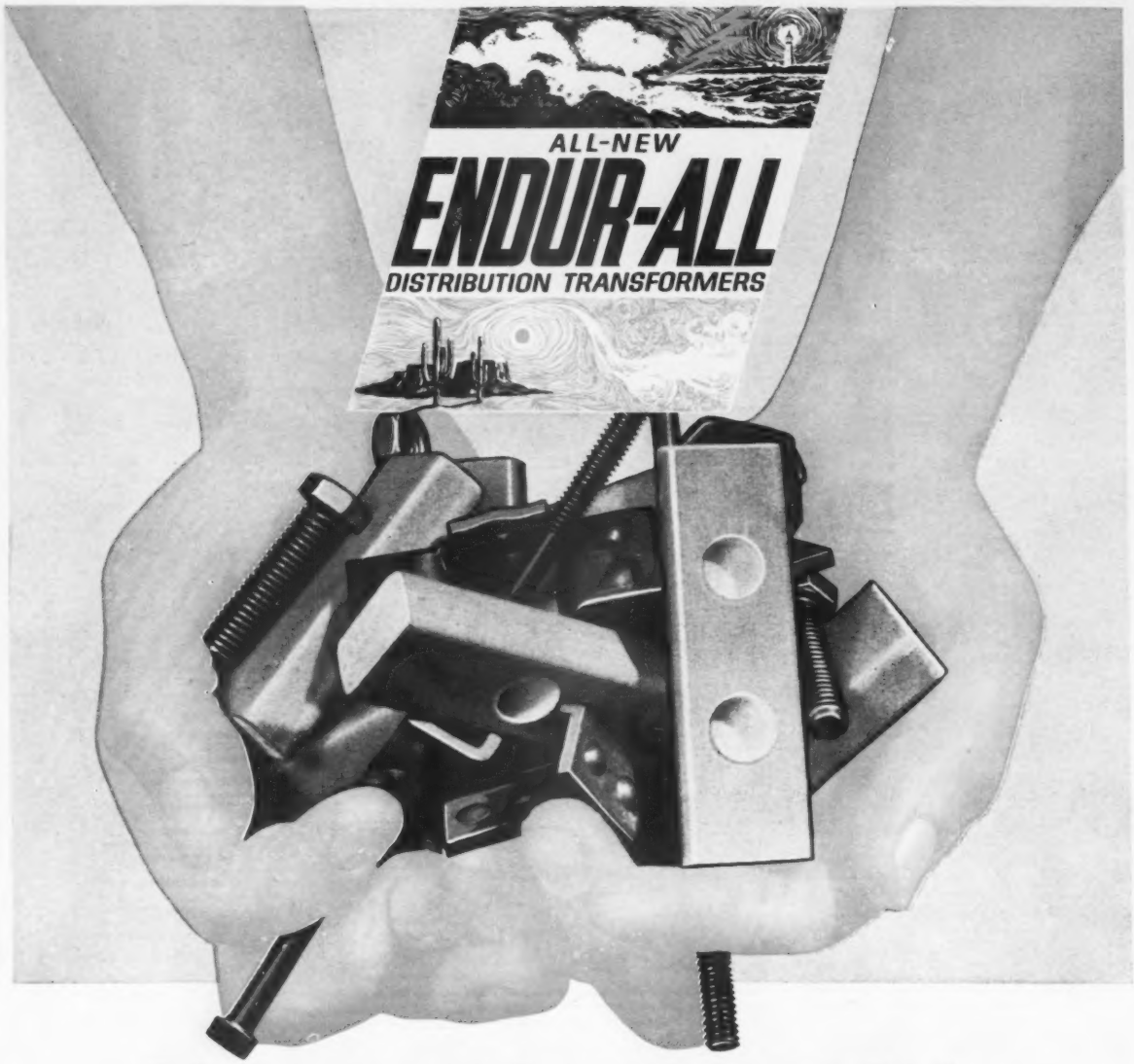


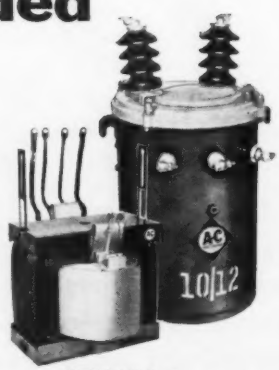
32 parts no longer needed

. . . 32 potential trouble-makers eliminated!

New locked core-and-coil end-frame construction eliminates 32 nuts, bolts and washers! Nothing to loosen . . . no welds to break. Unique A-C locking straps assure uniform high compression for *greater short-circuit strength.* And more duct area is exposed for *more* efficient cooling.

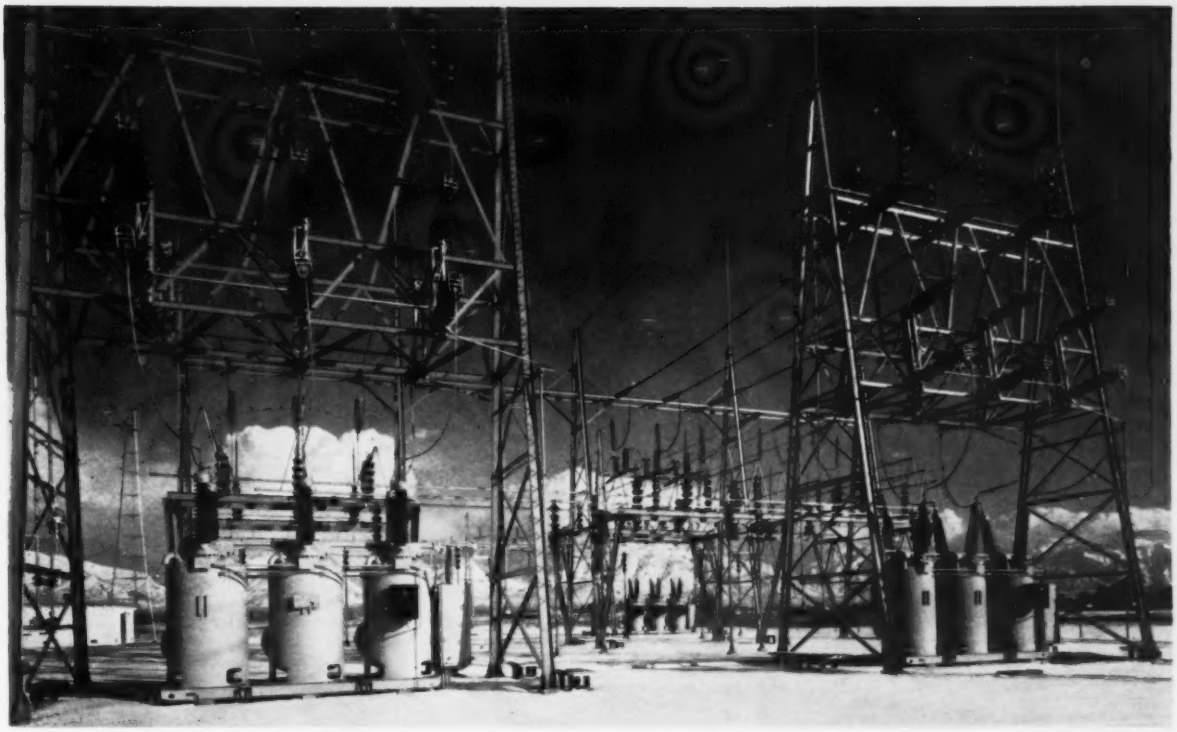
These additional A-C enduring values give you more for your ENDUR-ALL transformer dollar: New overload capabilities with new high-temperature oil and new high-temperature insulation • impedance is reduced as much as 25% — allows full utilization of the greater overload capacity • units are 10% lower, 10% lighter for easier hanging • new high-gloss-retention paint features 3 baked-on coats • new nonaging, reusable gasketing.

Call your nearby A-C office for more ENDUR-ALL *transformer facts or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*



ENDUR-ALL is an Allis-Chalmers trademark.

For phone number of closest representative see advertising index in back of book.



GOOD NEIGHBOR IN A BIG TERRITORY

Distances stretch far and mountains rise high in the territory served by the Utah Power & Light Company. The vision of the people stretches far and rises high also; and the people have a great capacity for progress. That is why the territory is growing.

New industries of many kinds are putting forth products. Mineral deposits are being brought into use. Modern agriculture and food processing are flourishing. And homes, homes, homes are going up.

Utah P & L is like the people it serves. Vision: it is one of 53 utilities building in the East a 40,000 kw prototype high temperature, gas-cooled reactor generating plant. It also is joining with 7 other Western utilities in a research program on thermoelectricity.

Progress: Utah P & L spends constantly to expand its facilities so more people can take more advantage of the territory's opportunities. Construction outlay in the past decade has been over $165 million.

Utah P & L enjoys a good neighbor relationship with its customers. For instance, farm and home customers pay an average of 2.11 cents per kw, 15% below the national average. Their average use is 4,470 kw per year, 17% above the national figure.

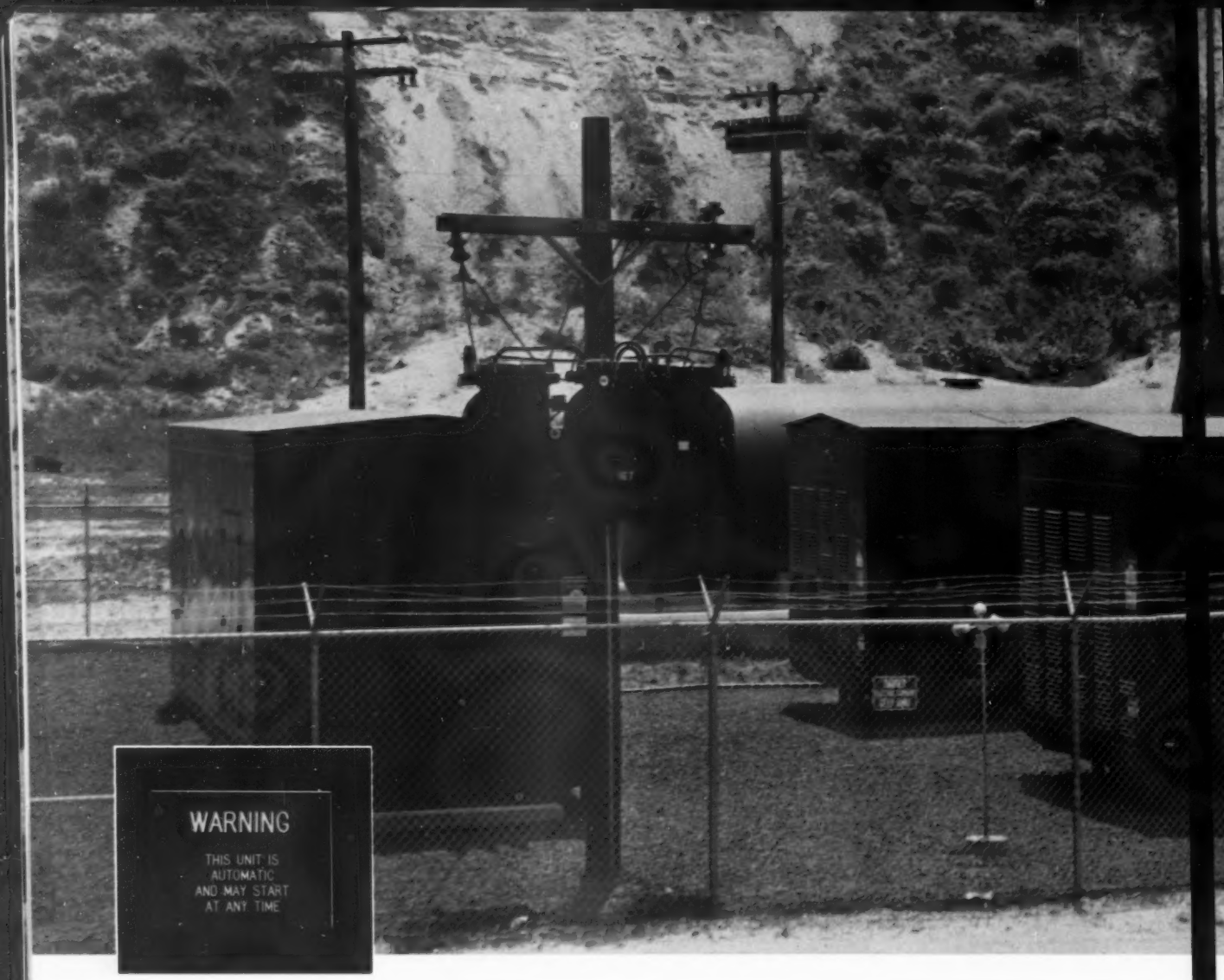
Utah P & L is a far-sighted good neighbor in its use of paint, too. It uses Subox paint for long-lived protection; and paints its substations with Subox aqua blue, a color as lively and pleasing as the territory the company serves.

SUBOX PAINTS

Subox Inc.
Trade Mark

Main Office & Plant: 18 FAIRMOUNT PARK, HACKENSACK, N. J. · *SALES ENGINEERS IN MOST MAJOR CITIES*

Affiliated Plants: Canada, Mexico, England, Belgium, Switzerland, Austria, Australia, New Zealand.



Long Island Lighting picks Diesel Peaking

Long Island Lighting Company has installed a 4000 KW Electro-Motive Peaking Plant at Northport, Long Island to provide area protection and spot peaking by remote control.

The Plant is designed to also supply construction power and emergency starting power for a large steam plant now being built.

WARNING—THIS UNIT IS AUTOMATIC: This sign, which is attached to the Electro-Motive Plant, points up an important operating feature. In the event that a line outage occurs at any time, and attempts to reclose fail, an automatic signal starts the Electro-Motive Plant. It comes up to full speed, synchronizes and loads in less than two minutes to provide emergency area protection. When service is restored, the Electro-Motive Plant automatically shuts down.

PEAKING SERVICE: In addition to providing emergency protection for the area, the Electro-Motive Plant will function as a spot peaking power generator. For this service it will be operated by remote control from the Hicksville Operations Center. And the quiet smoke-free operation of the Diesel Plant makes it ideal for its suburban location.

ADAPTABLE TO MANY FUNCTIONS—The inherent design characteristics of the Electro-Motive equipment on the Long Island Lighting

Plants for economical area protection

system that make it ideal for peaking and area protection, also make it well suited for many of your system requirements:

- fast start for spinning reserve
- automatic dead load pick-up for area protection
- unattended operation for remote peaking service
- freedom from damage to components caused by rapid thermal changes occurring from start to full load.

Available in units from 2000 KW to 10,000 KW, the Electro-Motive peaking equipment line contains both Diesel and dual-fuel plants that permit matching the plant to exact requirements for the most economical and efficient operation at the lowest investment. Ask your Electro-Motive representative for details.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS

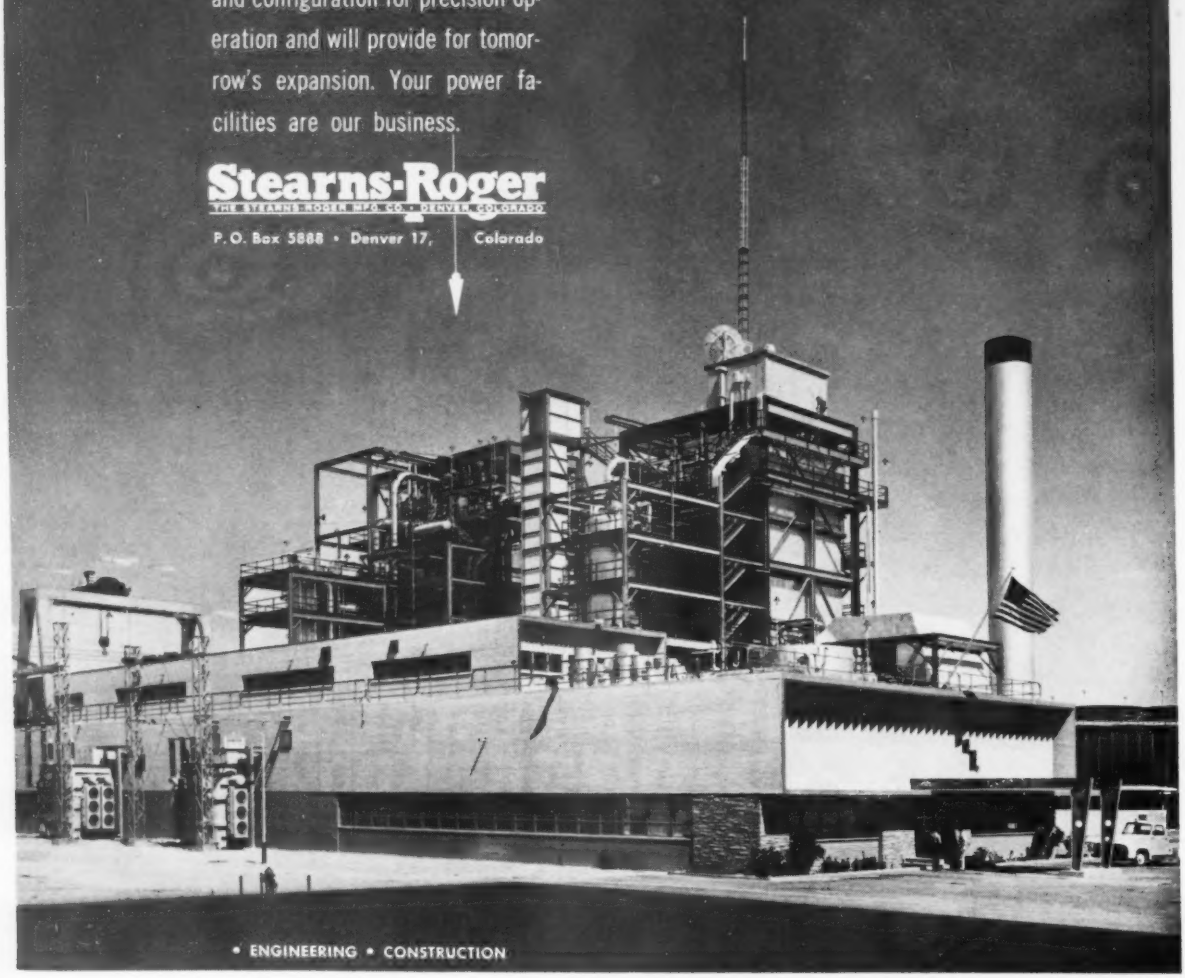
In Canada: General Motors Diesel Limited, London, Ontario

PUT THESE IN YOUR POWER PICTURE:

YESTERDAY'S EXPERIENCE.....
TODAY'S PRACTICE.....
TOMORROW'S PERFORMANCE...

Power plants by Stearns-Roger contain 75 years of engineering-construction background and the best of today's design concepts. With our help you can meet tomorrow's power requirements efficiently and economically. Your plant will incorporate equipment and configuration for precision operation and will provide for tomorrow's expansion. Your power facilities are our business.

Stearns-Roger
THE STEARNS-ROGER MFG. CO. • DENVER, COLORADO
P. O. Box 5888 • Denver 17, Colorado



• ENGINEERING • CONSTRUCTION

BLACKBURN PAC CLAMPS

In salt-laden coastal atmospheres, in fume-choked industrial areas . . . millions of Blackburn PAC clamps stay on the job year after year. No breakdown. No deterioration of electrical efficiency.

We've treated them even worse in our laboratory. Over 10 years of torturing salt spray and heat cycle tests, and they still perform like troupers. The PAC Series is the most corrosion resistant, electrically efficient BIMETALLIC connector in the world! The reason? Some exceptionally fine engineering and construction that eliminates soldered liners.

We'd like to show you how these extraordinary clamps are made and how they reacted to our severe testing. Write for Data Folder #6007.

Jasper
BLACKBURN
Corporation

1525 Woodson Road • Saint Louis 14, Missouri

For phone number of closest representative see advertising index in back of book.

INCREASE YOUR CURRENT

USS

American Steel and Wire
Division of
United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

CARRYING CAPACITY 45%

...with USS Amerzone-B insulation*

Amerzone-B butyl rubber insulation can be safely operated continuously at 90°C copper temperature. This means you get a 45% increase in current-carrying capacity with Amerzone-B as compared to the capacity of standard 60°C rated compounds. For network service, Amerzone-B will withstand emergency overload copper temperatures *up to 260°* for short periods without damage. No other rubber insulation has such exceptional resistance to heat, moisture, ozone and cold. You can bend it at —40°F. without cracking. Ozone tests to industry standards show no damage to this dense, nonporous insulation. Amerzone-B insulated cables installed over 12 years ago are just as good today as they were when installed. It's the ideal insulation for 5,000 to 15,000-volt cable. You can use USS Tiger Brand type RR Cable with Amerzone-B insulation anywhere . . . bury it, put it in conduits or ducts, string it overhead.

USS Tiger Brand type RR Cables are also made with other types of rubber insulation, each one compounded to do a special job. For complete information on Amerzone-B insulated cables or any other Tiger Brand Cable, call our nearest Sales Office or write American Steel and Wire, Dept. 1246, Rockefeller Building, Cleveland 13, Ohio.

USS, Tiger Brand and Amerzone-B are registered trademarks

*Conditions: 3 single conductors # 4/0 in 2½" conduit (exposed & enclosed), 40°C ambient air temperature

For phone number of closest representative see advertising index in back of book.

Now In The WEST

Holan Team To Help Utilities Launch Live Line Bare-Hand Method

A special Holan team will start a follow-up tour of Western utilities this month to present more detailed information on the live line bare-hand technique of working on live high-voltage lines.

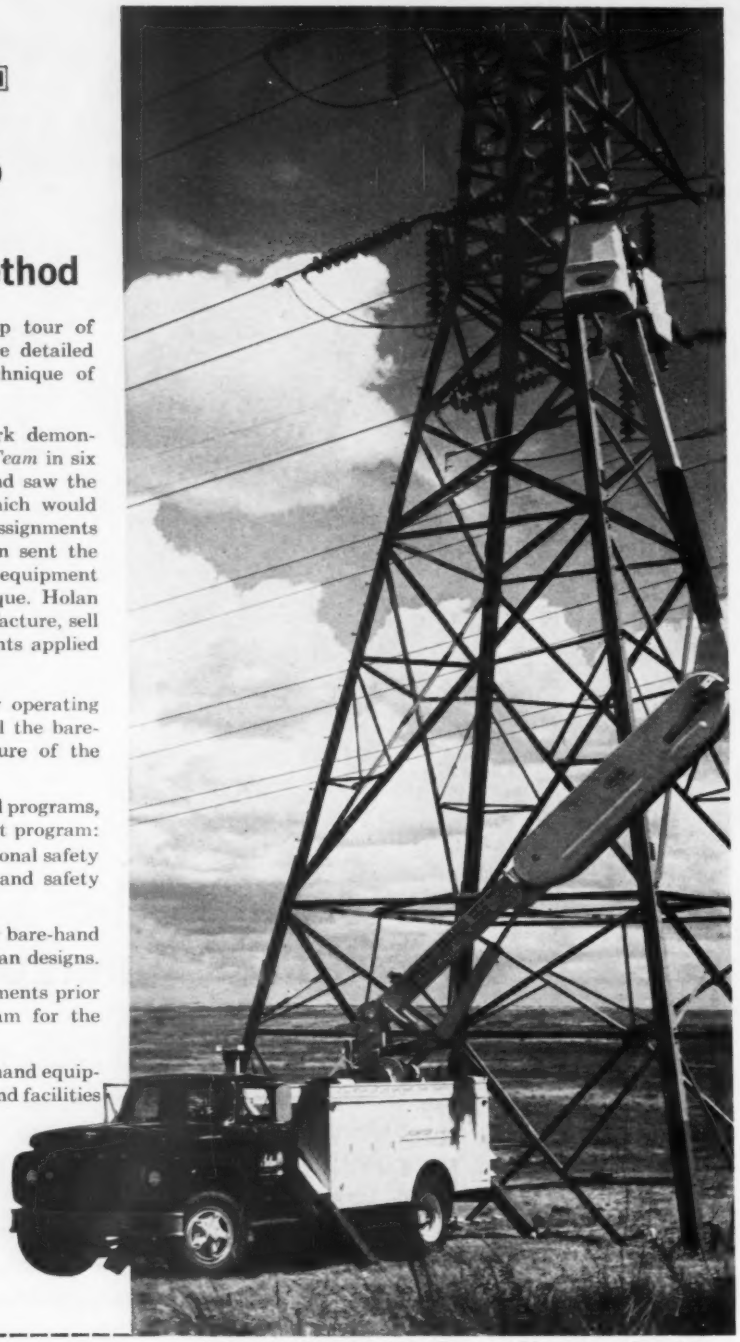
Nearly 350 utility executives witnessed work demonstrations of the *Holan Live Line Bare-Hand Team* in six locations during a recent two-week period and saw the team slash 122 manhours from the time which would have been needed to perform the six work assignments by conventional methods. Holan Corporation sent the team into the field April 1 after pioneering the equipment used in the development of the new technique. Holan has been granted the exclusive right to manufacture, sell and license the special metal shielding (patents applied for) used in the bare-hand method.

The Holan follow-up tour will enable utility operating and executive committees to discuss in detail the bare-hand method, its applications and the future of the program.

To help utilities launch their live line bare-hand programs, Holan representatives will offer this four-point program:

1. Coordinate the efforts of utilities and national safety groups in setting new work procedures and safety regulations.
2. Solicit utility equipment requirements for bare-hand work and incorporate them in future Holan designs.
3. Obtain utility personnel training requirements prior to establishing a Holan training program for the bare-hand concept.
4. Help establish testing standards for bare-hand equipment and make available Holan services and facilities for determining standards.

We are interested in your future bare-hand program and would welcome the opportunity to discuss the revolutionary new concept. Just fill in and mail the coupon and we will make the necessary arrangements.



Holan's Live Line Bare-Hand Team cut 26 manhours from the time needed to replace a jumper at this 134-kv dead-end tower that had become too tight during a conductor re-sagging program. The Holan team — now on a coast-to-coast tour — is proving daily that tremendous time savings are possible through the use of the bare-hand method of working on energized high-voltage lines.

HOLAN CORPORATION—TIMPTE DIVISION
5990 North Washington Street, Denver 16, Colorado

We would like to discuss the Holan Live Line Bare-Hand technique.

Name_____ Title_____

Company_____

Street_____

City_____ Zone____ State_____

Holan Corporation, 4100 West 150th St., Cleveland 35, Ohio

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

New! SPANG BLUE STAR CONDUIT

Now—from SPANG comes a new improved galvanized rigid steel conduit. Here's what it offers you:

NEW—*best thread protection available against rust*

. . . a smooth, uniform zinc galvanized coating on every ridge and valley of every thread . . . easy coupling—can be hand tightened the whole way . . . no thread chasing . . . no excess zinc . . . Preece-tested to assure quality and dependability.

NEW—*double galvanized coating on the conduit for extra corrosion resistance*

. . . inhibits white rust formation . . . eliminates flaking of finish . . . has that fine SPANGLEAM appearance.

NEW—*better packaging for easier handling*

. . . bundled in steel strapping in sizes up through 2" . . . shipped on a one-ton rectangular lift for convenient transit by lift truck...cuts handling costs—makes inventory easier.

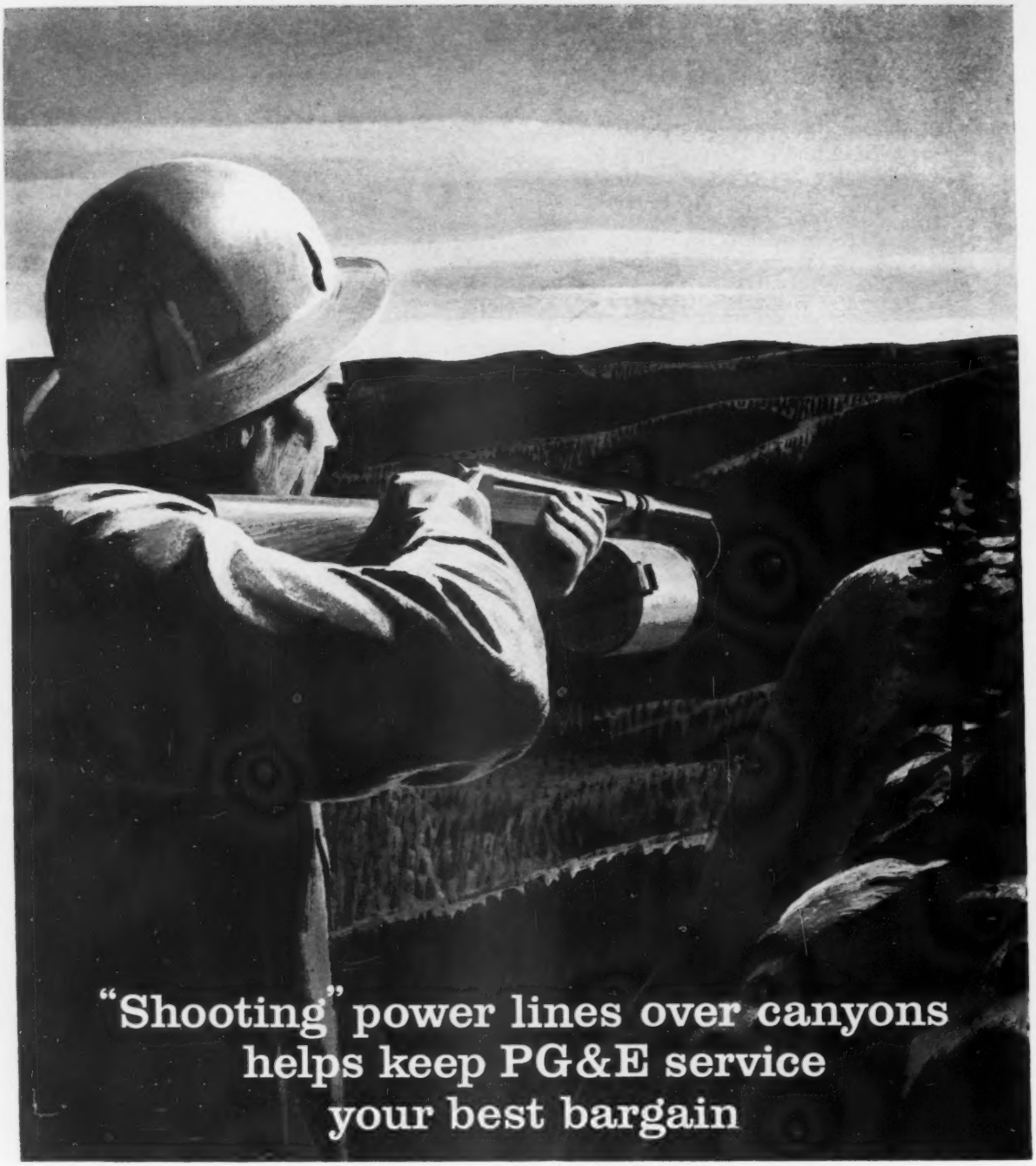
* * *

Save installation time, get top protection against rust and corrosion with new SPANG Blue Star Galvanized Rigid Steel Conduit. See your nearby SPANG Distributor for complete details and samples.

SPANG Blue Star Conduit is one of the many fine products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Penna.*

ARMCO National Supply Division

For phone number of closest representative see advertising index in back of book.



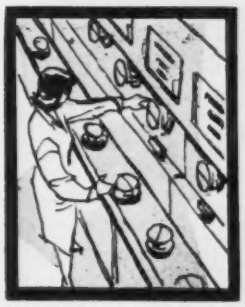
431-X-1061

If you see a PG&E lineman with this strange-looking gun, he's stringing power lines—not hunting. Canyons, dense trees, streams and other obstacles slow up power line construction. But not with a modern line-throwing gun! It can shoot a light line more than 400 feet over obstructions—then the power line is attached and hauled through otherwise impassable sections quickly—and economically. Saving time and construction costs with efficient methods like this is another example of creative engineering at Pacific Gas and Electric Company as it builds ahead for a state on-the-grow.

CREATIVE ENGINEERING PIONEERING RESEARCH PROGRESSIVE PLANNING

41 strategically located warehouses

Computers speed telegraphic punched-tape processing



Production programmed to orders

ANOTHER GENERAL ELECTRIC METERING EXTRA . . .

Overnight delivery from 41 local warehouses

To help you cut metering equipment inventory costs, keep stocks balanced, General Electric's standard high-volume meters, sockets and instrument transformers are available for immediate delivery from 41 stock points in G-E's unique "Jet Stream Service" warehouse system.

New Jet Stream advances mean even faster delivery. For example: single-phase demand meters and transformer-rated single-phase meters not warehouse-stocked are now shipped in only five working days, cut from four weeks. And, polyphase meters are shipped in just six working days.

Here's how Jet Stream Service keeps local stocks of G-E's high-quality metering products available for your needs. Daily, punched-tape reports on sales in each of the 41 warehouses (regional and local) are telegraphed to the factory. By computer processing, the factory (1) directs replenishment of local warehouse stocks from six regional stocks, (2) replenishes regional stocks, and (3) programs production to meet current needs. General Electric's program of best service, plus superior products, adds up to your best metering buy. Get the full story—product and service—from your G-E Sales Engineer.

713-09

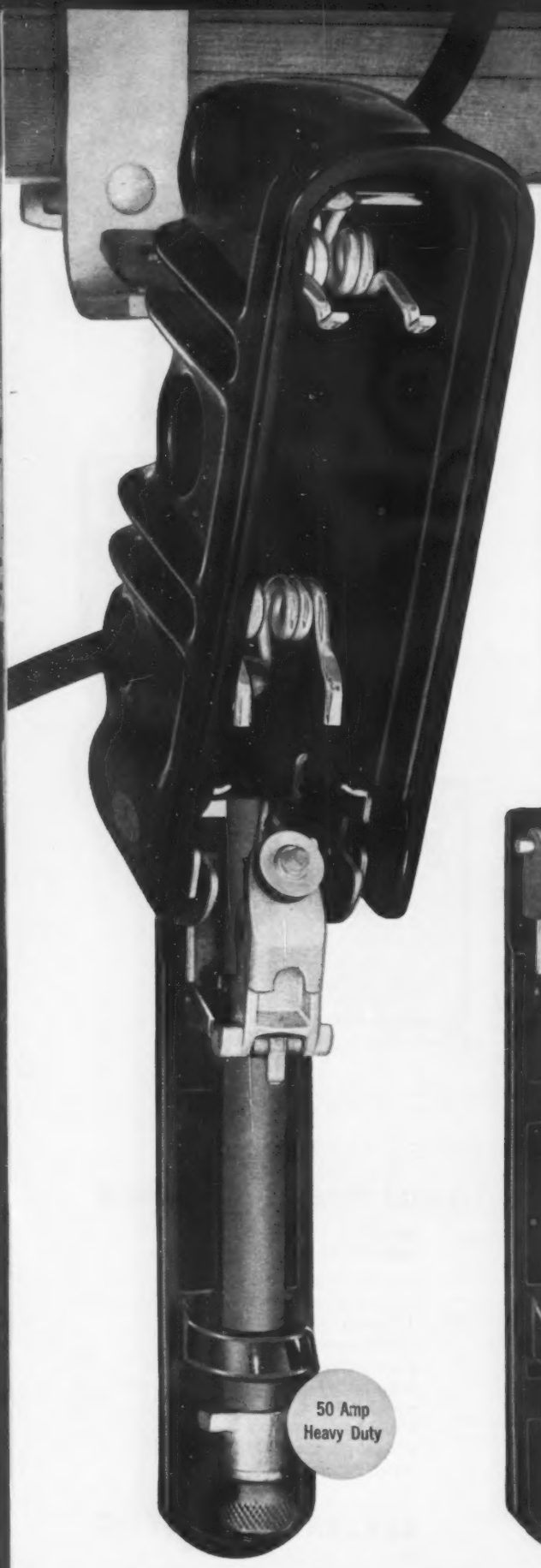
YOU GET ALL 10 METERING EXTRAS FROM GENERAL ELECTRIC

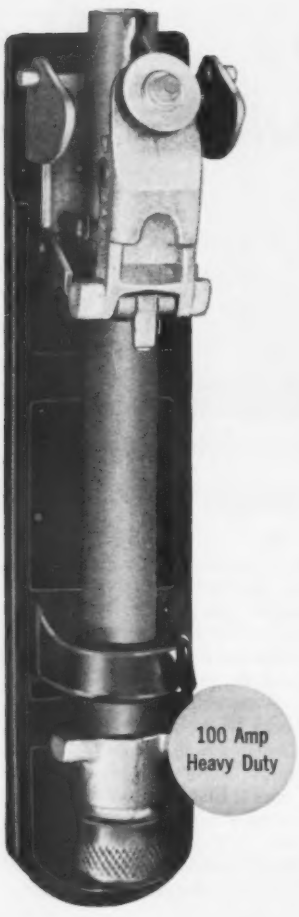
- Jet Stream Service
- Statistical Sample Testing Seminars
- Certified Quality
- Meter Courses
- Low Cost per KVA
- Application Assistance
- Product Service
- Load Building Programs
- Industry Communication
- Local Personalized Sales-Service

GENERAL ELECTRIC

KEARNEY PACE WITH

	Cutout Rating		Type	Interrupting Rating RMS Asymetrical Amperes			Cat. No.
	Volts	Amps		2.6 KV	5.2 KV	7.8 KV	
HD	5200	50	Indicating Non-Indicating	8000	5000		49409
HD	5200	100	Indicating Non-Indicating	8000	5000		49410
EHD	5200	100	Indicating Non-Indicating	14,000	10,000		49411
	5200	200	Dead Blade Disconnect				49410-200
HD	7800	50	Indicating Non-Indicating	8000	5000	4000	49412
HD	7800	100	Indicating Non-Indicating	8000	5000	4000	49413
EHD	7800	100	Indicating Non-Indicating	14,000	10,000	8000	49414
	7800	200	Dead Blade Disconnect				49413-200





ENCLOSED CUTOUTS KEEP EXPANDING SYSTEM NEEDS!

...can be inexpensively uprated any time in the future...by simply changing doors

Kearney Enclosed Cutouts provide an ideal solution to a perplexing, two-fold problem faced by many power systems today:

First, that of specifying low-cost, dependable fault protection fully adequate for present needs, yet adaptable enough to comply with the future requirements of a rapidly expanding system... and second, that of uprating to the levels of future system demands without incurring exhorbitant and unnecessary costs of usable product obsolescence.

In addition to their low first cost, Kearney Enclosed Cutouts give greater long-range value for every cutout dollar... because they can be quickly and inexpensively uprated in continuous ampere rating, interrupting rating, or both, by simply changing doors... whenever expanding system requirements make it necessary. Each of two porcelain boxes accepts four interchangeable door assemblies and provide adequate interrupting capacities to meet any future needs up to 8,000 amperes at 7.8 KV, 10,000 amperes at 5.2 KV and 14,000 amperes at 2.6 KV.

Buy now and plan ahead for the future. By specifying Kearney Enclosed Cutouts now, you can minimize inventories, reduce ultimate maintenance costs, eliminate the high cost of later removal and replacement of entire units... and be prepared to meet future system demands for dependable fault protection.

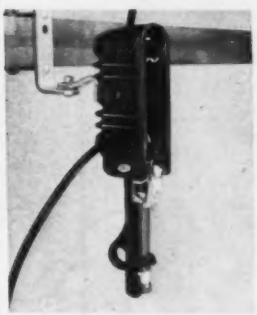
Important Design Improvements...

Economy, higher interrupting capacities and interchangeability of doors have been achieved with no increase in price or sacrifice of high quality. Improved lower trunnion construction permits entire recoil thrust to be absorbed by the trunnion, porcelain box and a heavy duty hanger rather than by the upper contacts; thus high pressure low-resistance contact is maintained during each interruption and throughout the service life of the cutout. Heavy duty hangers are standard equipment on all Kearney Enclosed Cutouts, to adapt the cutout to future system requirements.

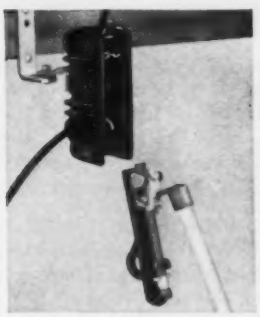
A highly efficient spring flipper whips fuse link cable out of cartridge, assures positive low fault interruption. Re-fusing is simple, foolproof... cartridge locks in position even if lineman fails to snub fuse link leader tight ... contact pressure cannot change.

Lengthened cartridge tube projects slightly below the box to prevent any deflection of ionized gas which might cause internal flashover.

Plated, box-type terminals accommodate up to 4/0 stranded copper and aluminum conductor. All current carrying parts are non-ferrous. Duronze hinge pins, silver-to-silver contacts. Bolt-thru construction of contacts, brackets and terminals... parts cannot loosen or pull out of housing.



Doors drop out to full 180° angle in the indicating position.



Doors may be easily removed or inserted from any angle with standard hookstick.

Easily converted to non-indicating by inserting only one screw.

For phone number of nearest office see advertising index in back of book

for better construction... safer maintenance... specify KEARNEY products

KEARNEY

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue • St. Louis 10, Missouri

PLANTS AT: ST. LOUIS • MELROSE PARK, ILLINOIS • FAYETTEVILLE, ARKANSAS • GUELPH, ONTARIO, CANADA • ST. THERESE, QUEBEC, CANADA

Watthour meters are designed to do their job indefinitely. But occasionally repair may be required . . . a truck grazes the meter . . . a rock breaks the cover and dents the register . . . the meter is dropped, the disk bent. Whatever the cause, Sangamo sectionalized construction enables quick, easy, inexpensive repair.

Any major J3 component can be inspected or repaired without completely disassembling the meter or returning it to the manufacturer. There is no paper work delay; the meter is back in service quickly . . . reducing meter stocks.

Parts inventory? Kept to a minimum: all major J3 components (except frame and moving system) are interchangeable with the J2. You can even install J3 magnetic flotation on J2 meters. The economies of sectionalized construction are realized immediately when you standardize on the J3 . . . unsurpassed in metering values.

true MAGNETIC flotation J3

SANGAMO ELECTRIC COMPANY
SPRINGFIELD ILLINOIS

PW61-9

Meetings Calendar

OCTOBER

3-5—*Electric League of Southern California,* Lighting Progress Exposition, Palladium, Hollywood, Calif.

5-6—*Northwest Public Power Assn.,* Accounting and Finance Section, annual meeting and Workshop, Snohomish County PUD Auditorium, Everett, Wash.

16-18—*Northwest Electric Light & Power Assn.,* Business Development Section, Davenport Hotel, Spokane.

26-27—*Pacific Coast Electrical Assn.,* Hawaiian conference, Princess Kaiulani Hotel, Honolulu.

NOVEMBER

6—*American Institute of Electrical Engineers,* Los Angeles Section, third Western technical conference, Biltmore Hotel, Los Angeles.

24-29—*Electrical & Home Appliance Show,* Balboa Park, San Diego.

27-28—*Pacific Coast Electrical Assn.,* Administrative Services Section, fall conference, Miramar Hotel, Santa Barbara, Calif.

DECEMBER

7-8—*Washington Public Utility Districts Assn.,* annual meeting, New Washington Hotel, Seattle.

JANUARY 1962

14-19—*Los Angeles Winter Market.*

18-19—*Public Utilities Advertising Assn.,* Region 9 meeting, Palm Springs, Calif.

22-26—*San Francisco Market,* Western Merchandise Mart.

FEBRUARY

12-15—*Air Conditioning, Heating & Refrigeration Industry,* 12th National Exposition, Biltmore Hotel, Los Angeles.

26-27—*Pacific Coast Electrical Assn.,* Business Development Section, Huntington-Sheraton Hotel, Pasadena, Calif.

MARCH

21-23—*Northwest Public Power Assn.,* 12th annual Engineering & Operations Workshop, Pasco, Wash.

22-23—*Pacific Coast Electrical Assn.,* Engineering & Operating Section, Sheraton-Palace Hotel, San Francisco.

26-27—*PCEA,* Administrative Services Section, spring conference, Villa Hotel, San Mateo, Calif.

APRIL

16-18—*Northwest Public Power Assn.,* 22nd annual meeting, Empress Hotel, Victoria, B. C.

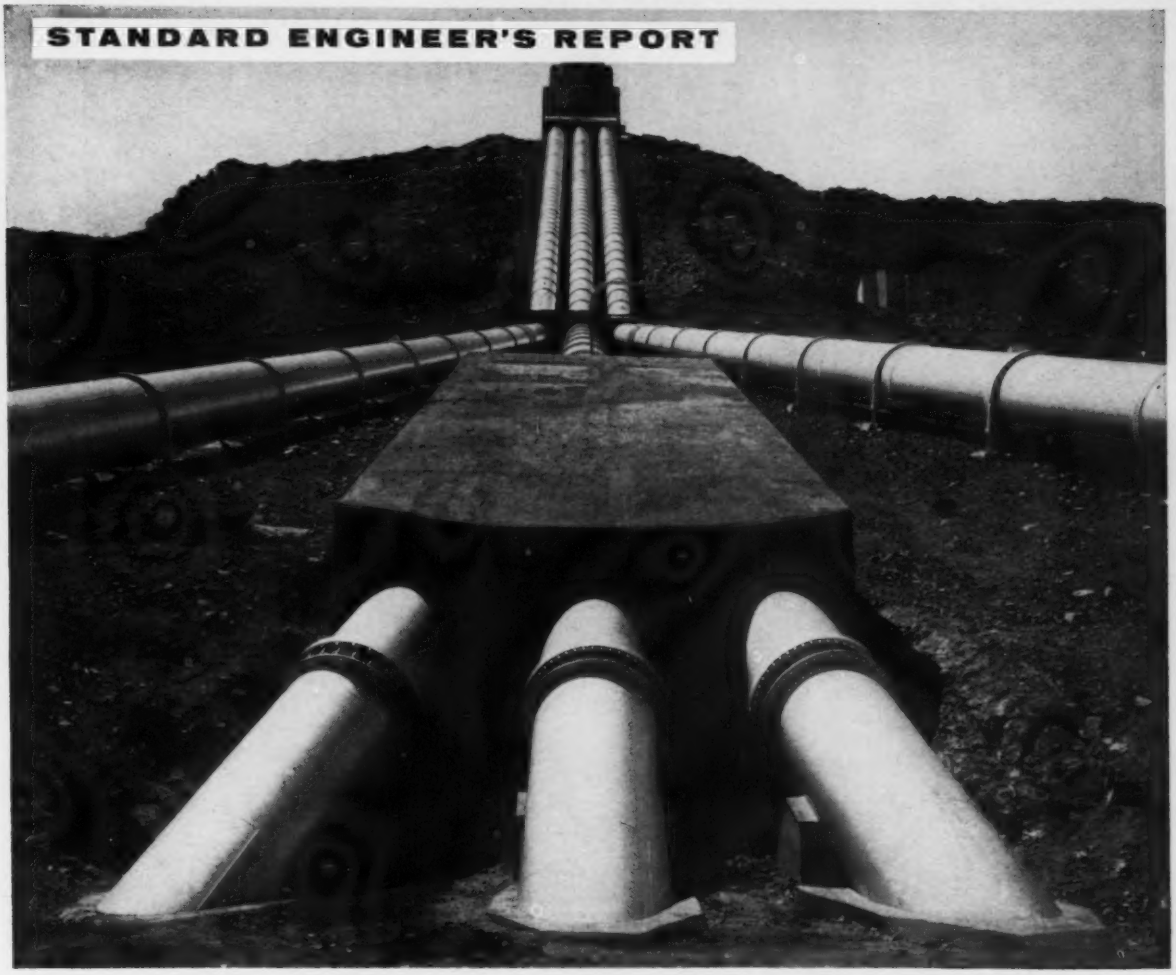
25-29—*Western Space Age Industries and Engineering Exposition/Conference,* Cow Palace, San Francisco.

MAY

16-18—*Pacific Coast Electrical Assn.,* annual convention, Ambassador Hotel, Los Angeles.

17-18—*Illuminating Engineering Society,* Pacific Northwest regional conference, Spokane.

STANDARD ENGINEER'S REPORT



Chevron OC Turbine Oil helps pump a river over Eagle Mountain!

12,000 gallons of water a second are forced over Eagle Mountain by the big pumping station near Desert Center, California. This station is one of five pumping plants on the 654-mile Colorado River Aqueduct System, longest and largest domestic water supply line in the United States.

Chevron Turbine Oils have been used here for over 20 years to lubricate all bearings in 200 cfs Worthington centrifugal pumps and 12,500 hp Westinghouse and Elliott motors. These three-story pumping units are continuously subjected to start and stop duty which is hard on bearings and on lubricants. Yet, in over two decades of service there has never been a lubrication failure.

O. J. Thompson, Station Chief, reports: "At our last major inspection, bearing surfaces showed only minimum normal wear. Chevron Turbine Oils have given outstanding performance ever since the plant was opened in 1939."

This vast aqueduct system is owned and operated by the Metropolitan Water District of Southern California. It supplies a billion gallons of water a day to 5 Southern California Counties, including 90 incorporated cities.

Standard Lubrication Engineers, working with MWDSC personnel, recently completed a thorough analysis of all lubricants and equipment in the system . . . to assure economical lubrication and high quality performance throughout.

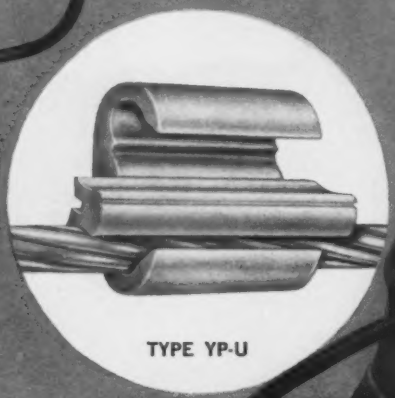
Lubrication Problems? Let a technically qualified Standard Engineer help you. The largest field force of lubrication engineers in the West is at your service. For this valuable free technical help or for information on any petroleum product, just call your local Standard office, or write Standard Oil Company of California, 225 Bush Street, San Francisco 20.

CHEVRON Industrial Lubricants

STANDARD OIL COMPANY OF CALIFORNIA

TRADEMARK "CHEVRON" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

FEWER, BETTER CONNECTORS



TYPE YP-U

NEW

universal compression tap connectors cover complete conductor range with 40% fewer sizes

CABELOK™ CRIMPIT®— ONLY TAP CONNECTOR WITH ADJUSTABLE SPACER

Ask your Burndy representative for a demonstration. See how simple CABELOK CRIMPIT is to install . . . it's adjustable spacer can lock on tap or run or when properly positioned — will retain both.

BURNDY

HYTOOL® TYPE MD6 installs all types of overhead connectors — including INSULINK® and LINKIT® service entrance connectors as well as CABELOK CRIMPIT and full-tension HYSPLICE® on overhead line conductors from #6 thru 4/0.

SIMPLE DIE CHANGE — Die recess is also a crimping groove — only one die for entire CABELOK CRIMPIT range. Dies snap in easily . . . lock positively.

NORWALK, CONNECT. BICC-BURNDY Ltd. Prescot, Lancs., England. In Europe: Malines, Belgium. **TORONTO, CANADA**

01-22

NEWS

Edited for the electrical industry of the West

B. C. May Find Power Market in Northwest, Luce Says

Bonneville Administrator Charles F. Luce revealed in a talk to the Electric Club of Oregon Sept. 7 that he has suggested to B. C. officials that they seek a market for surplus power among private utilities in the Pacific Northwest.

Luce said he had conferred informally with Dr. Gordon M. Schrum, president of the B. C. Power Co., and chairman of the B. C. Energy Board.

The Bonneville administrator suggested that Pacific Northwest private utilities might welcome, under certain conditions, a long-term supply of power, available from B. C. if the pending Columbia River treaty is ratified by the Canadian parliament.

"British Columbia might very well find a market for a substantial portion of power generated at U. S. downstream plants under the treaty without going beyond the boundaries of the Pacific Northwest," Luce said. B. C.'s downstream share of Columbia River treaty power would total 1,300 mw.

Luce said rates on the downstream power returning a reasonable profit to B. C. would probably be about the same as private utilities now pay for Bonneville power. And BPA power now serving the utilities would be released for industrial customers.

B. C.'s Premier Bennett desires to export all or a large part of B. C.'s treaty power that would be generated at U. S. dams, Luce said. Indications are that the province will not need the power for 20 to 25 years.

B. C. Plans Burns Lake Project

Queries have been raised in British Columbia as to why the government has approved proposals of its Crown company, B. C. Power Commission, to spend $10 million on a small hydroelectric project in the Burns Lake area when its other government utility, the recently acquired B. C. Electric, has announced it will proceed with the Peace River development immediately and thus make abundant power available in the same area.

Hon. K. Kiernam, minister of mines and a member of the power commission, states the chief reason is that power will be needed in at least two years while the Peace project will take six to seven years to develop.

He said oil-operated diesels were B. C.'s most expensive power source and the hydro project would be cheaper. He said the $10 million Fulton River Dam and power plant would develop only 15,000 kw, which was needed, and would not interfere with the Peace project.

While the government has approved the right of the B. C. Power Commission to apply to the proper provincial authorities for water rights for the project, there still has to be a formal hearing of the application.

Senate Group Applies Brakes

A week after the House voted down a motion that would have deleted funds for federal transmission lines for the Upper Colorado Storage project, the Senate appropriations committee put the brakes on federal spending for this purpose. The committee approved the funds for line construction voted by the House but prohibited expenditure of part of the appropriation until further efforts are made to work out wheeling agreements with private companies. Such arrangements would eliminate duplicating transmission lines.

The report directed that funds be used for three specified lines (Flaming Gorge-Oak Creek; Glen Canyon-Curecanti-Poncha; Gunnison-Blue Mesa-Curecanti-Montrose) and that with respect to other proposed lines the Secretary of Interior and the USBR exhaust every possible effort to reach wheeling agreements with the private utilities to accomplish their purpose and that the officials report back to the Senate and House appropriation committees no later than Feb. 15, 1962. Committee vote on the directive was 12 to 10.

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Power Export Discussed At Seattle Meeting

Selling surplus Columbia River power to California would be a profitable venture if the Pacific Northwest could be sure of getting the power back when it needs it, probably about 1975.

This appeared to be the concensus at a meeting of the Columbia Interstate Compact Commission Sept. 11 in Seattle.

Best argument for sale of the power is the hope that it would reduce the deficit of the Bonneville Power Administration, estimated by Administrator Charles Luce to reach $15 million this year. Luce pointed out that some $32 million worth of Columbia River power will be unused this year because a market for it is lacking.

Ken Billington, executive secretary of the Washington PUD Assn., expressed the fear of Bonneville customers that Bonneville might raise its rates in 1964 unless it can get "back into the black." Since low-cost electricity is one of the area's best industrial assets, such an increase would be regarded with consternation in many quarters, he pointed out.

Most forceful speaker against export of power, over a transmission line requiring an investment of $160 to $200 million, was H. Dewayne Kreager, now a private economic consultant in Seattle after serving as head of the Washington State Department of Economic Development. He estimated the Pacific Northwest would be short of firm power in seven or eight years and would have difficulty in recalling any power it might sell to California. Furthermore, California would use the added power supply to its own advantage in competition for new industries, Kreager said.

Also taking a dim view of the proposed line was Maurice Hatch of the Washington Water Power Co., who estimated the Northwest had "less than a 10% chance" of getting back any of the power. Any exchange of power would result in Northwest hydro displacing the "cheapest steam power" in California while steam power returned to the Northwest during hydro shortages would be "most expensive," he predicted. Hatch recalled the 1952 brownout in the Pacific Northwest, when "the power we purchased from California

was the most expensive I've ever seen, at 2c a kwh."

The Washington Water Power executive also expressed concern about the nature of the intertie line.

"The nonfederal agencies can't build the line by themselves without an agreement with the Bonneville Power Administration, which has more than half of the available secondary power," he points out. "All the secondary power in the area, federal and nonfederal alike, would be required to pay for the line."

Hatch objected to "common carrier" provisions of a proposed federal line which would allow private utilities to use the line "only when Bonneville is not." He also sees difficulty in determining whose secondary power should be sold, since both federal and nonfederal agencies have supplies available. Hatch proposed that the Northwest "concentrate on saving its secondary energy to use in conjunction with Canadian storage."

Sol Schultz, manager of H. Zinder & Associates, consulting engineering firm which has studied the proposed intertie for California agencies, spoke as the principal proponent of the line. California's steam generation would enable the Pacific Northwest to firm up 400,000 kw of secondary hydro energy "at less cost than Canadian treaty power" during low water years, he said. Schultz agreed with Billington that the line, paying for itself in 10 years, would be of continued value in coordinating power supplies of the two areas.

The commission elected Thomas R. Newell of Boise, Idaho, as its new chairman, with Alex Coleman of Idaho Falls as vice chairman and John Cooney of Spokane as secretary.

► **Although all legal obstacles to the construction** of the main arch of Tacoma's Mayfield Dam have been removed by the announcement that the sportsmen suit for injunction will be abandoned, physical problems are still frustrating the city's contractor, working in Mayfield Canyon on the Cowlitz River. Judge Hale, Pierce County Superior Court, has signed an order admitting the sportsmen to intervene in a test case filed by the city challenging the validity of Initiative 25, passed at the last election. Lee Olwell, attorney for the sportsmen, states no new effort will be made.

► **Vancouver, B. C., will spend $581,000 on a street lighting program** immediately as a winter works project. The work was planned for spring but is being advanced to provide winter employment.

Dedication ceremonies during the construction of Sierra Pacific Power Co.'s new thermal plant. The first of two gas-turbine units will go on the line by Nov. 1, 1961, to be followed by a second in 1962 and larger steam-turbine units in subsequent years. Standing at the edge of the foundation for the first unit are: (left to right) Frank A. Tracy, Sierra Pacific's board chairman, for whom the plant is named; Edward L. Pine, president, Isbell Construction Co.; Nevada's Gov. Grant Sawyer; Charles Hammond, Westinghouse Electric Corp., supplier of the first unit; and Fred L. Fletcher, president of Sierra Pacific Power

One-Year Coordination Agreement Is Signed In Northwest

A one-year coordination agreement designed to maximize power production at Pacific Northwest power plants (EWEST News Letter, September) has been signed by Bonneville Power Administration, the Corps of Engineers and nine private and public utilities.

Under the agreement, the federal government will receive $1,100,000 from downstream nonfederal power producers for assured capability from upstream federal storage. Smaller payments will be made by and among the nonfederal parties for nonfederal upstream storage benefits.

The agreement was cited by Interior Secretary Stewart Udall as evidence that "the United States has moved rapidly into a position to implement the treaty with Canada for joint development of the Columbia River." BPA Administrator Charles Luce said the one-year agreement is a pilot plan expected to lead to a long-term coordination agreement. He said such a coordination agreement is desirable even without regard to the treaty that necessitates it.

Signing the pact in addition to BPA and the Corps of Engineers were Grant, Chelan and Pend Oreille County PUDs, City of Eugene, Montana Power, Washington Water Power, Puget Sound Power & Light, Pacific Power & Light and Portland General Electric companies.

Aluminum Co. of America, which owns a share of the output of Rocky Reach Dam, was expected to sign following review of the contract by company officials in the east.

At presstime the city of Tacoma still had the agreement under consideration and Seattle had declined to sign the multiparty contract but had indicated interest in a separate agreement with Bonneville. Seattle's Paul J. Raver earlier had told the city council that he could not recommend participation because "there are just too many important unanswered questions." City Light has no way of knowing yet what the agreement might mean to its proposed $100 million Boundary Dam on the Pend Oreille River or on its long-standing arrangements with Tacoma City Light for exchange of power, he said.

► **The University of Oregon will pay the $5,000 additional cost for underground** electric service to Westmoreland Village, a married student housing center, but will add 60c a month to rental charges to recapture the amount. The Eugene Water & Electric Board will make the installation, which will total $10,696.

Realignment in B. C.

Major realignment of the territories served by the B. C. Electric and B. C. Hydro have been announced by Premier W. A. C. Bennett. The change is effective Jan. 1, 1962, and is the first major move since B. C. Electric was taken over by the government toward coordinating with the B. C. Power Commission.

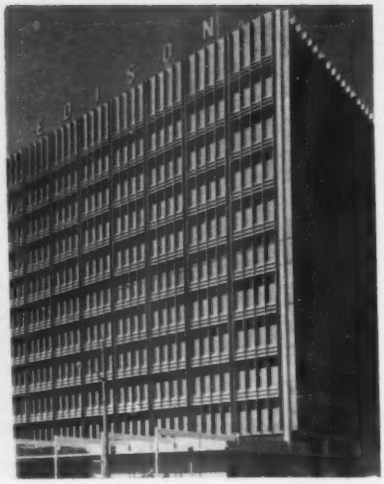
B. C. Electric will take over the Cariboo district and central and northern B. C. from the B. C. Hydro and will retain the lower mainland and Fraser Valley areas. Whether the power plants and transmission systems will be transferred is also left unclarified in the Premier's announcement but it would seem to be directed mainly at the power distribution systems.

The B. C. Power Commission (B. C. Hydro) will continue its distribution in Nanimo, the Albernis and northern Vancouver Island areas and take over distribution in Victoria city and district from the B. C. Electric. The B. C. Electric has no operations in the Okanagan and Kootenay areas but these have been added to the territory of the B. C. Power Commission. Presumably if the government proceeds with its announced consideration of taking over the West Kootenay Power & Light and the East Kootenay Power companies now serving this area, they would be turned over to the power commission. If Premier Bennett can work out his differences with Ottawa it will be the B. C. Power Commission that will handle the project, which is in the Kootenay area.

Undecided About Kootenays

No decision has yet been reached by the B. C. Government in regard to taking over the East and West Kootenay power companies. Premier Bennett in a national TV broadcast said "we may or we may not" take over these companies. He also said the B. C. government had definitely no intention of taking over any other private industry.

Despite denials already made by B. C. Electric officials, Bennett repeated that the government's move in taking over the company had "at least stopped any more increases" in power rates. He said the pattern had been for the B. C. Electric "to win increases in rates from time to time . . . We wanted to stop the increases and eventually bring reductions for our own industries."



Southern California Edison Co. has moved part of its administrative staff into a new all-electric 10-story office building in Long Beach, following the official dedication and open house on Aug. 21. Towering above the business district, just a few blocks from the ocean, the $5,000,000 Edison Building is ringed with windows and affords a commanding view of Long Beach, its harbor and shoreline

Do-It-Yourself PUD

Directors of the Keizer Rural Fire Protection District, covering a nine-square-mile suburban area of Salem, have asked the Oregon state engineer to authorize their area as a PUD without election under terms of an Oregon law never before used.

Oregon's law governing PUDs appears to provide that utility districts may be formed in this manner on the structure of an existing taxing district without an election.

But there is a serious question whether the 1933 legislature intended that a fire district, which has limited powers, could become a PUD, which has great powers, including that of condemnation, without an election. The state engineer has asked Oregon's Attorney-General Robert Y. Thornton for an opinion on application of the law to the Keizer situation.

The area has about 7,000 population and is now served by Portland General Electric.

► **Pacific Power & Light Co.** has started removal of an old hydroelectric dam on the Umatilla River near Hermiston, Ore. The dam, being removed to clear the stream for fish passage, served the city's power needs with a 150-kw generator from 1913 to 1940, when PP&L acquired the system from Hermiston Electric Co.

Right-of-Way Measures Protested

The Wyoming PSC has protested a proposed amendment in the federal law to increase the costs of right-of-way on Bureau of Management lands.

The Wyoming PSC said the proposal would result in increased rates for telephone, electric, gas and pipeline services.

The proposed amendment, published in a federal register June 21, would boost the present rate of $5 per mile for crossing BLM land to a minimum of $5 per acre.

Albert P. Bruch, PSC chairman, said the change would increase rates for most utility companies in Wyoming and the boost would be passed on to consumers.

In its formal protest, the PSC said the increase would be discriminatory, would hinder expansion of service into rural areas, would increase surface damage claims and would be contrary to procedural due process of law since it provides for no hearings or oral arguments.

Appointment Brings Resignation

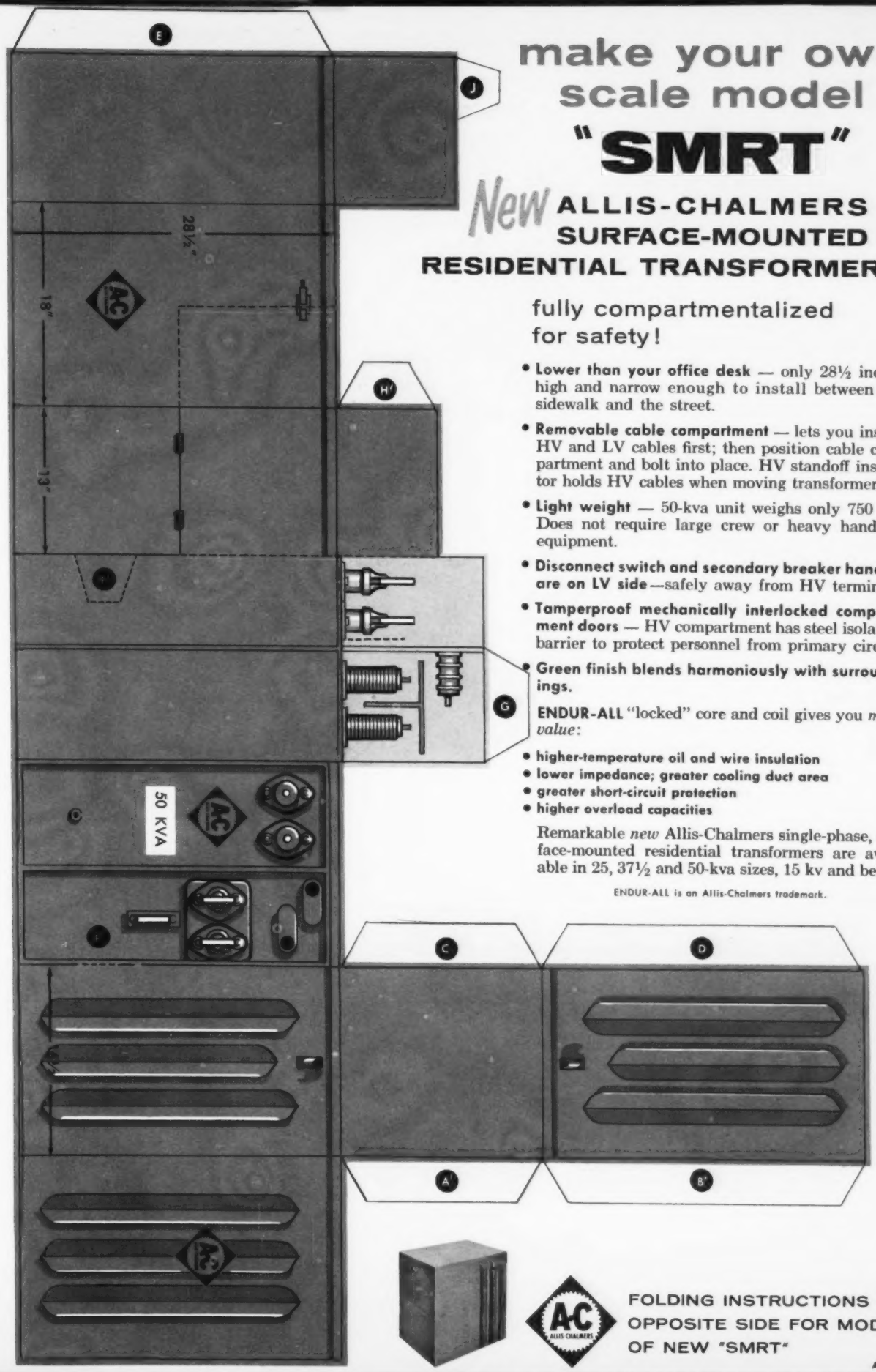
Appointment of an ex-employee of the Clark County PUD as a PUD commissioner brought about the resignation Aug. 29 of Vincent M. Cleaveland, manager of the PUD since 1947.

"I think appointment of a former employee as a commissioner establishes a dangerous precedent which would interfere with the efficient administration for which I am responsible," Cleaveland said in a letter of resignation. His resignation is effective Oct. 1.

Cleaveland, an employee of Clark PUD since 1942, is a director of the American Public Power Assn. and a past president of the NWPPA.

► The Tacoma Utility Board has approved a **$158,200 project to place power lines underground in the Fawcett Avenue urban renewal area.** The cost of the underground utility system will be listed as a credit toward the city's one-third share of the net project cost, according to Urban Renewal Director Robert Maffin. In effect, Maffin said, the federal government will put two dollars into the project for every dollar spent by City Light on the underground lines.

► **Pioneer on the Columbia,** the story of Bonneville Dam, is available to the public on a loan basis from the U. S. Army Engineers at Portland. It runs for 28 minutes.



make your own scale model "SMRT"

New ALLIS-CHALMERS SURFACE-MOUNTED RESIDENTIAL TRANSFORMER

fully compartmentalized for safety!

- **Lower than your office desk** — only 28½ inches high and narrow enough to install between the sidewalk and the street.
- **Removable cable compartment** — lets you install HV and LV cables first; then position cable compartment and bolt into place. HV standoff insulator holds HV cables when moving transformer.
- **Light weight** — 50-kva unit weighs only 750 lbs. Does not require large crew or heavy handling equipment.
- **Disconnect switch and secondary breaker handles are on LV side**—safely away from HV terminals.
- **Tamperproof mechanically interlocked compartment doors** — HV compartment has steel isolation barrier to protect personnel from primary circuit.
- **Green finish blends harmoniously with surroundings.**

ENDUR-ALL "locked" core and coil gives you *more value*:

- **higher-temperature oil and wire insulation**
- **lower impedance; greater cooling duct area**
- **greater short-circuit protection**
- **higher overload capacities**

Remarkable *new* Allis-Chalmers single-phase, surface-mounted residential transformers are available in 25, 37½ and 50-kva sizes, 15 kv and below.

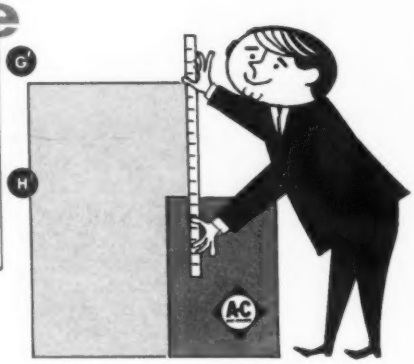
ENDUR-ALL is an Allis-Chalmers trademark.

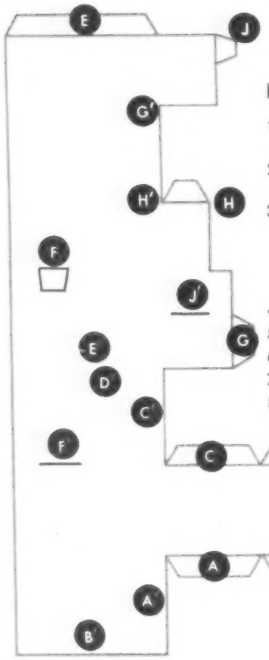
FOLDING INSTRUCTIONS ON OPPOSITE SIDE FOR MODEL OF NEW "SMRT"

A-1528

COMPARE SUPER-COMPACT ALLIS-CHALMERS SURFACE-MOUNTED RESIDENTIAL TRANSFORMERS WITH ALL OTHERS!

"SMRT" is less than ¼ the size of the average of six other makes





FOLDING INSTRUCTIONS

1. Punch out model along perforated edge.
2. Crease down along all scored edges.
3. Fold part containing tabs A B C D over so that they are opposite marked positions A′ B′ C′ D′ and glue in place to form transformer housing.
4. Insert tab F in slot F′.
5. Fold and glue tab G to G′.
6. Fold and glue tab E to E′.
7. Fold and glue tab H to H′.
8. Insert tab J into J′.

Check the chart below! It introduces you to new dimensions in surface-mounted residential transformers. Example: the A-C 50-kva "SMRT" is just 28½ inches high, 29 inches deep and 18 inches wide! That's just 15,660 cubic inches of cabinet compared to competitive cabinets as large as 83,927 cubic inches. Smaller size means easier shipping and handling. Foundation, labor and equipment costs are lower.

Dimensions of A-C 50-kva Surface-Mounted Residential Transformers "SMRT" compared with six other makes

Make	A-C	Brand A	Brand B	Brand C	Brand D	Brand E	Brand F
Height	28½	41	46	43	38¼	38½	42
Depth	29	34	44½	48½	40	45	49
Width	18	36	41	40	37	40	36
Cubage	15,660	50,184	83,927	83,420	56,610	69,300	74,088
% larger than A-C	—	220%	440%	430%	260%	340%	370%

Weights of competitive units are correspondingly greater.

Write, wire or phone your nearby A-C office for more surface-mounted residential transformer facts or copies of Ad A-1528. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

Pacing Power Progress

► The new $145 million production reactor under construction at the AEC's Hanford Works near Richland, Wash., **will produce some electric power** despite Congressional action in regard to adding generating facilities. Steam from the heat exchanger system will be used to operate a 15,625-kw stand-by generator at the reactor installation, AEC officials at Richland said recently. Steam also will be used to operate turbine-driven pumps to recirculate water in the reactor's primary coolant loop.

Boundary Project License Upheld

The FPC has upheld granting of the Boundary project license to Seattle City Light and denied the applications for rehearing requested by the Pend Oreille County Public Utility District and the mining interests.

In its order of Sept. 6 denying the request for a rehearing, the FPC made only one modification to its original order of July 10, 1961; it reinstated the FPC examiner's provision assigning 48,000 kw of Boundary project power to the PUD if and when needed to meet local requirements within the PUD's service area.

The 48,000-kw allocation would be reduced by the amount of any power recaptured by the PUD under the Box Canyon contract with Seattle and sold for use outside Pend Oreille County. City Light has been buying nearly all of the output of the Box Canyon plant since 1955.

The allocation of power does not affect City Light's plans as it has continuously offered to make available to the PUD a block of Boundary power at cost for use in the county.

► The **Western Underground Committee** has adopted a proposed standard for 12-kv pad-mounted transformers. It is believed that the underground committee standard is the first to be adopted anywhere in the country. Important features of the standard design include: (1) high-voltage and low-voltage compartments on one end; (2) self-protective design including secondary breakers and high-voltage fuse link; (3) two stand-off insulators, and (4) interchangeability between transformers and cabinets.

► **Arizona Public Service Co.** has placed $12 million worth of $2.625 cumulative preferred stock, $50 par, with institutional investors. First Boston Corp. and Blyth & Co. acted as agents.

WASHINGTON REPORT

Federal Retaliation

What happens when the 50-year licenses of nonfederal hydro power projects expire has been raised again in Congress, this time by Sen. Lee Metcalf (D.-Mont.).

Metcalf raised the issue this time as sort of "retaliation" against the lobbying pressure by power companies against the Hanford reactor and the Upper Colorado transmission line issues. Previously, the question of expiring licenses was brought up in a 1958 hearing by the old House legislative oversight subcommittee. Nothing was concluded in that hearing, although former FPC General Counsel Willard Gatchell told the House unit that any federal takeover of private projects (whose licenses had expired) might cost more than some people anticipated.

Later, last January, the House unit made a cryptic statement, in its year-end report, that a "federal vs private power fight of unprecedented proportions" might grow out of the expiring licenses, unless federal policy was established in advance of the event.

Metcalf related the license study directly to the Hanford battle: "It is disturbing that the day after the Russian cosmonaut circled the earth 17 times and landed safely in his homeland, directing world attention to his nation's accomplishments in the new space sciences, an alignment of vested interests would even seek to prevent the construction of the world's biggest atomic generating plant in this nation . . . if the government is going to be stopped short every time a new science approaches practical application, then perhaps we had better start looking at opportunities to undergird our security by recapturing some of the old fashioned means of production, including the generation of energy. Along this line, I have compiled a list of hydroelectric projects in the U. S. on which licenses will expire in the next 10 years . . .

"We need to know how well the private utility industry has done its job as the agent of the government, whether it has provided the nation with most modern facilities and an abundance of electric power at low prices, or if it has acted as a brake on development, retarded extensions of services—as in the case of rural areas—and facilitated or retarded our economic growth."

Under the Federal Power Act, licenses can be renewed for another 50 years either to the same or a new licensee, or the federal government can take title. In the latter two situations, adequate compensation must be paid the previous licensee. Another possibility is that the licenses could be renewed on an annual basis to the previous licensee, while final determination is considered.

Manana Mood

The late days of Congress revealed a willingness to pass over several front-burner power issues until 1963, among them: (1) a bill to create a national water resources council, river basin planning commissions and a 10-year, $5,000,000 annual federal aid program for states to improve local water projects; (2) a similar measure to create a natural resources planning unit at the White House—broader than the water council—and possibly, also, a joint congressional committee on natural resources; (3) the Fryingpan-Arkansas and Burns Creek power projects were both stalled in the House of Representatives until 1963; (4) a bill to create a Delaware River compact commission went down to the wire in a deadlock between the Kennedy administration (which wants a preference clause included in the compact) and spokesmen for the four involved states, who claim the clause isn't needed nor would it be politically obtainable from their state legislatures.

A surprising last-ditch action by the House appropriations committee saw a $150,000 study okayed for possible pumped storage power projects of the Interior Department. Earlier, House Interior Chairman Wayne Aspinall (D-Colo.) had held a brief hearing by his committee to consider authorizing such a study, but he put over completing the hearings until January. Aspinall, reportedly, was a little miffed at the appropriation committee's willingness to approve funds for the study before Aspinall's committee had had a chance to look at or authorize spending the money.

However, the Interior committee apparently won't object to the designation of these funds in the big public works appropriation bill for that purpose. Studies will be carried out —a reconnaissance-type study—in the 17 Western states. Later, if the bureau finds a need for such power, and finds many suitable sites, the

Corps of Engineers also may make a study to augment the USBR.

Studies would look at possible federal power sites and would consider how private pumped storage projects could be licensed at federal reservoirs, and how such operations could be billed to pay part of the federal reservoir's cost.

New Look at FPC

A "new" Federal Power Commission—now with a Democratic majority—has taken charge in Washington. Joseph Swidler became chairman of the FPC Sept. 1, on a previously reached agreement with former Chairman Jerome Kuykendall, who stepped back to commissioner.

Lawrence J. O'Connor was given the oath of office, joining Howard Morgan as the rest of the Democratic majority.

One of Swidler's first moves as new chairman was to strengthen the FPC's bureau of power, by adding to it all electric utility rate regulation and power reports. Swidler also revised the old offices of bureau of rates and gas certificates, and accounting. And he created a new office of FPC economics.

A study of the nation's fuels and energy needs was assured before Congress this year, when the Senate approved a study for this by the Senate interior committee. The committee, earlier, had considered a bill (by Sen. Jennings Randolph of W. Va.) to create a special senate committee to study fuels and energy needs. A sum of $200,000 also had been recommended for the special study, with a cutoff date of January 1963.

The study finally approved by the committee, however, was considerably different in procedure, although identical in purpose and scope: only $25,000 would be appropriated, the Interior committee would conduct its own study—with the addition of three senators from eastern coal and oil-burning areas—and the completion date would be January 1962. This might be extended another year.

Much of the delay, and change, in the Interior committee's final recommendation—the one the full Senate approved—was due to the battle over the Hanford reactor. Interior Chairman Clinton Anderson (D-N. M.) had held up the study (which reportedly would help coal producers more than any other single fuel source) until he knew how coal-state congressmen planned to vote on the Hanford issue.

COMMUNICATIONS

Wrong Synchronization

AIEE and WESCON got together in August, synchronized their oscillators and generators, and held their meetings the same week in different western cities. Since both meetings are of interest to electric utility communications men this could have been very frustrating. Unhappily for AIEE the Pacific general meeting had a great dearth of papers pertaining to our communications problems, and Wescon did have a few which were pertinent to mobile radio usage, so, theoretically at least, Wescon was the best bet.

The Wescon papers dealt with the problems occasioned by the continued channel splitting procedures and the consequent decrease in spacing between channels. The use of cavity resonators, crystal filters, notch filters and similar devices for removing undesired signals or signal products was discussed in detail. Geographic spacing of base stations was suggested along with mathematical expressions and curves for determining the magnitude of interference. If several base radio stations, or in fact radio stations of any kind, are operating adjacent to one another as on a hilltop, calculation of the intermodulation products may become a very gruesome task. One speaker suggested that with proper programming a computer would be a powerful tool for the application engineer.

While the AIEE meeting had very little pertinent to communications, it was interesting to note that the relaying discussions kept coming around to communications channels as a weak point in the systems. Pilot wire channels came in for the greatest amount of criticism in general, and one speaker remarked that leased lines had some three times the trouble that was experienced on their private lines.

► With the increasing use of remotely controlled or automated substations, power plants and similar facilities, many routine checks on equipment operation are falling by the wayside. One casualty has been regular readings on carrier pilot channels for relaying. These can be checked for operation of the receiver and transmitter at one terminal, or if supervisory is available, for the whole system on a nonquantitative basis. This doesn't give a good picture of receiver operation at the remote station; however, in an effort to remedy this unsatisfactory situation, PG and E is testing a system to **telemeter carrier pilot channel readings** back to the control station. The prototypes are being made by Noller Control Systems of Oakland to meet the requirements at a cost considerably less than that of the more elaborate gear which is now in common use. Most engineers, particularly those with large numbers of carrier blocking terminals, won't have to dig far back in their memories to remember channel malfunctions which could have been picked up before they happened by such a scheme.

May Expand VHF TV

A possible expansion of VHF TV may result from recent proposals by the FCC which were published in the Aug. 11 issue of the Federal Register. The commission feels that expanding use of TV will shortly result in congestion in the VHF band, or has already, which can not be expanded to cope with it adequately. They propose several solutions, among them being one which would vacate the VHF band and put all commercial TV in the VHF region, which is now lying largely fallow. Should this proposal be adopted a mad scramble for the frequency space will surely occur. Fortunately, electric utilities' interests will be well protected through NCUR.

► A rather amusing but effective application of radio has recently been made in Yellowstone Park by the National Science Foundation, the National Geographic Society and Montana Wildlife Research, and others. They are **equipping grizzly bears with small radio beacon transmitters** having a short range of about five miles. Since the bears aren't noted for their good dispositions it is necessary to knock them out with a shot of tranquilizer in a special syringe which is fired from a safe distance or used after they are trapped. The batteries are good for a few months and consequently it will be possible to spot their location at any time and thus provide information which will assist in the preservation of the species which is believed to be on the way to extinction. Too bad they can't use mikes and broadcast what bears say to one another when alone.

GROWTH

PG and E Pit License

The FPC has issued a 50-year license to Pacific Gas and Electric for a proposed $86.7 million 329,400-kw hydroelectric project on the McCloud and Pit Rivers in Shasta County, Calif.

The proposed project would consist of three developments—McCloud-Pit, Pit No. 6 and Pit No. 7. PG and E proposes to divert water from the McCloud River to a power house on the Pit River where it will be combined with Pit River flows and used through the proposed Pits 6 and 7 developments. The water diverted from the McCloud River would make it possible for the company to increase the installed capacity of the two Pit River plants by 50,000 kw, or 40%.

The McCloud-Pit development would consist of a concrete arch diversion dam on the McCloud River; a reservoir with a gross storage capacity of 35,300 acre-ft; a tunnel 17 ft in diameter and 40,500 ft long; an earthfill dam on Iron Canyon Creek creating a reservoir with a gross storage capacity of 24,400 acre-ft; a tunnel 19 ft in diameter and 12,500 ft long; and a power house with an installed capacity of 155,700 kw.

The Pit No. 6 development would consist of a concrete gravity dam located on the Pit River; a reservoir with a gross storage capacity of about 15,700 acre-ft; and a power house with an installed capacity of 73,800 kw. The Pit No. 7 development would consist of a concrete gravity dam located on the Pit River; a reservoir having a total storage capacity of 34,000 acre-ft; and a power house with an installed capacity of 99,900 kw.

PG and E sought a license for each of the three developments. The FPC, however, found that the developments would be integrated both hydraulically and electrically and would be operated as a single project. In these circumstances, the commission said it believed the three developments should be placed under a single license.

► Columbia Electric Co. of San Francisco has been awarded a $54,319 contract by the U. S. Army Engineers for furnishing **low-voltage switchgear for Cougar Dam** now under construction 50 miles east of Eugene on the South Fork McKenzie River. Equipment includes one 6,900/480-v double-ended substation, one 480-v duplex control center, one 125-v d-c, 120-v a-c control sources distribution board, two 125-v d-c battery chargers, one inverter set and one lot of accessories and spare parts.

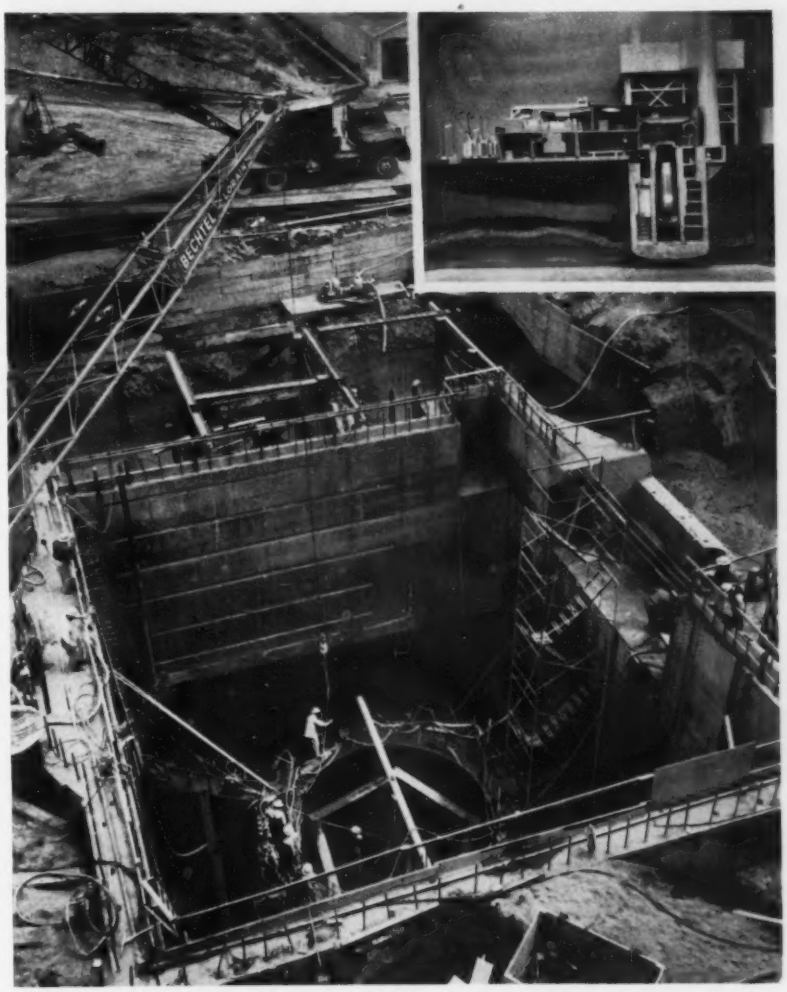
Peace Tunnel

Contract for a work tunnel as the first step in the development of the Peace River in British Columbia will be placed by B. C. Electric. Dr. Gordon Shrum, named chairman of B. C. Electric when it was taken over recently by the B. C. government, states the company is moving as rapidly as possible toward development of the Peace River.

The work contract to be placed in September will cover a tunnel that will ultimately form one of the three diversion tunnels costing $18 million. The B. C. highway department has started an access road to the proposed Portage Mountain Dam site near Hudson's Hope in north central B. C.

B. C. Electric is filing formal application for the water rights.

► **New Power Plant Added to Colorado Project**—The Bureau of Recla-



PG AND E A-PLANT ONE-QUARTER BUILT—Construction of Pacific Gas and Electric's Humboldt Bay nuclear unit near Eureka, Calif., has reached 25% of completion. The huge below-ground caisson that will contain the nuclear reactor has been completed and installation of apparatus within it has begun. Workmen in the picture are standing on the edge of the caisson's inner cylinder into which the reactor pressure vessel will be inserted. The caisson extends 85 ft below ground level, contains 5,100 cu yd of concrete and 244 tons of welded steel plates. The 60,000-kw nuclear-fueled electric generating station is scheduled for completion late in the summer of 1962. It will cost $20 million

More Capacity for the West in these New Developments

Pacific Power & Light Co.'s $7,500,000 Iron Gate Project, an earthfill reregulating dam for the Klamath River hydroelectric developments which Pacific acquired in its merger with Copco, reached the half-completed point in August. Scheduled for operation in December, Iron Gate's power house will add 18,000 kw to Copco Division capability. Earth haulers dump their final loads atop the 173-ft. dam structure in September

Jaybird power house of the Sacramento Municipal Utility District's Upper American River project began generating power recently with its first 66,500-kw generator, first of two to be installed. The power house, located on Silver Creek in El Dorado County, 60 miles from Sacramento, has a 2,500-ft penstock that drops 1,500 ft into the canyon. This development is designed to produce 238,000 kw at first and ultimately 500,000 kw

mation announced it will construct a hydroelectric power plant at Fontenelle Dam on the Green River as part of the Seekskadee project in southwestern Wyoming. Seekskadee is a participating project of the Colorado River Storage Project. Capacity will not exceed 10,000 kw.

Yuba Seeks FPC License

Yuba County Water Agency of Marysville, Calif., has filed an application with the FPC seeking a license for a proposed hydroelectric project on the Yuba River and its tributaries in Yuba, Nevada and Sierra Counties, Calif.

The proposed project would consist of an impervious core, rockfill dam, about 633 ft high and 1,800 ft long, across the North Fork Yuba River and creating a reservoir with gross storage capacity of 930,000 acre-ft; four diversion dams, on the Middle Yuba River, Oregon Creek, North Yuba River and Yuba River, having a combined storage capacity of 8,635 acre-ft; six tunnels; and three power houses, having a combined installed capacity of 295,000 kw. The cost of the proposed project is estimated at about $148,030,000.

Yuba County Water Agency proposed to sell power generated at the project to Pacific Gas and Electric.

REA Loans Approved

Arizona: Mohave Electric Cooperative, Kingman, $187,000 to finance construction of 29 miles of distribution line and to make general system improvements.

Utah: Moon Lake Electric Assn., Vernal, $3,299,000 to finance acquisition of the properties of Uintah Power & Light Co. and to construct 322 miles of distribution line, 11 miles of 69-kv line and two substations and a new hydro unit.

Wyoming: Carbon Power & Light Inc., Saratoga, $531,000 to finance construction of 31 miles of distribution line and two substations.

Big Horn Rural Electric Co., Basin, $446,000 to finance construction of 66 miles of distribution line and two substations.

► **Low total bid submitted** to the Chugach Electric Assn. of Anchorage, Alaska, for constructing power lines on the Kenai Peninsula, was submitted by Gustav Hirsch Organization Inc. of Anchorage. The bid would cover constructing 39 miles of distribution lines and a short transmission line in the vicinity of Moose Pass and Cooper Landing.

S & C power fuses are going places

The power fuse has come a long way in fifty years —from S&C's liquid fuse to S&C's sophisticated, boric acid fuse of today. Now, with interrupting ratings up to 1,000,000 kva in the Type SM (720 amperes continuous), and 2,000,000 kva in the Type SMD (540 amperes continuous), S&C power fuses are being adapted to virtually every conceivable system protection need. Power fuses are used indoor and outdoor; enclosed and in the open; in plants and buildings; on transmission and distribution lines; on overhead poles; in pad mounted gear; and in underground vaults. These fuses provide predictable protection with simplicity and economy. That's why they are going places.

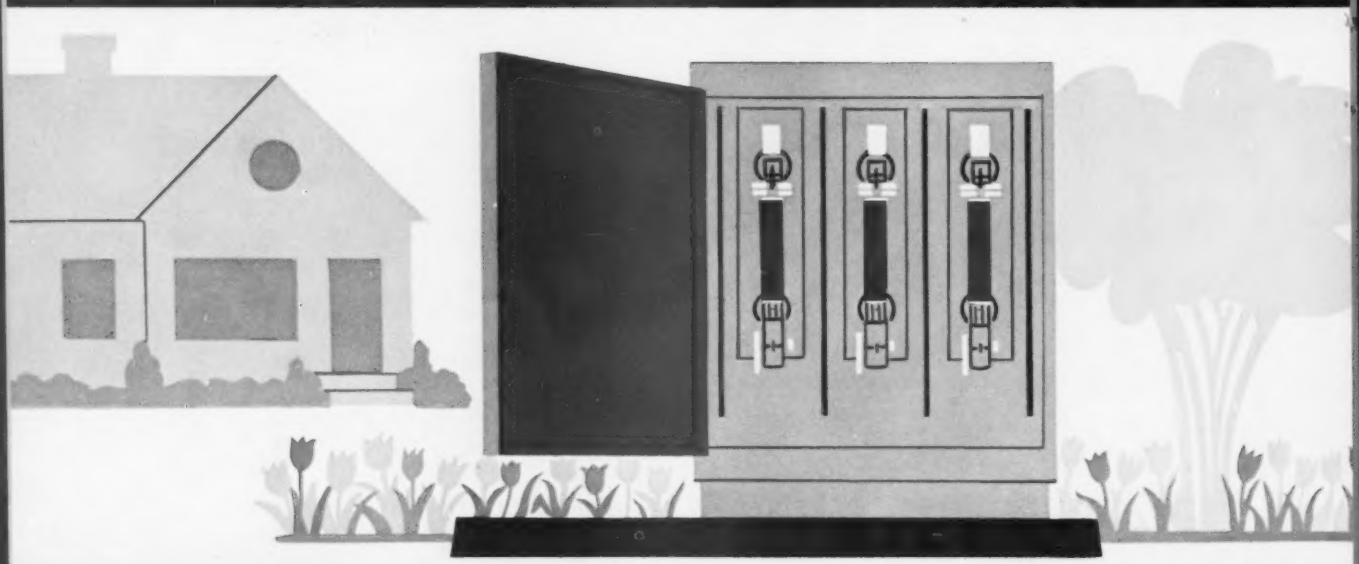
S&C

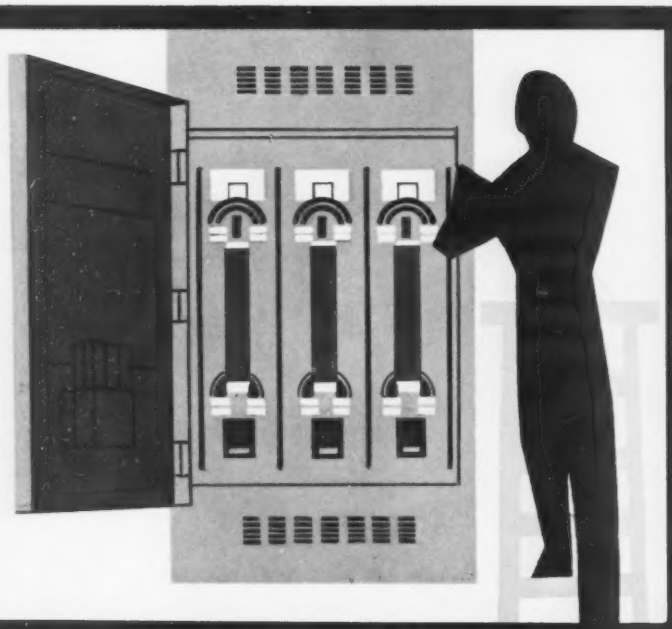
OUR GOLDEN JUBILEE

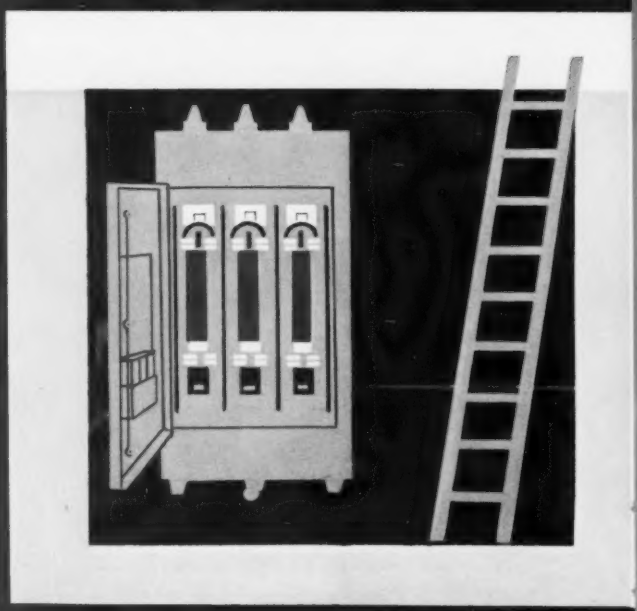
Places like these:

IN PAD MOUNTED GEAR

At sectionalizing points or connected to pad mounted transformers, S&C power fuses protect (and even switch) residential underground circuits—in air. The wide choice of fuse ratings enables the utility to uprate its underground system to accommodate future growth needs.







ON WALLS

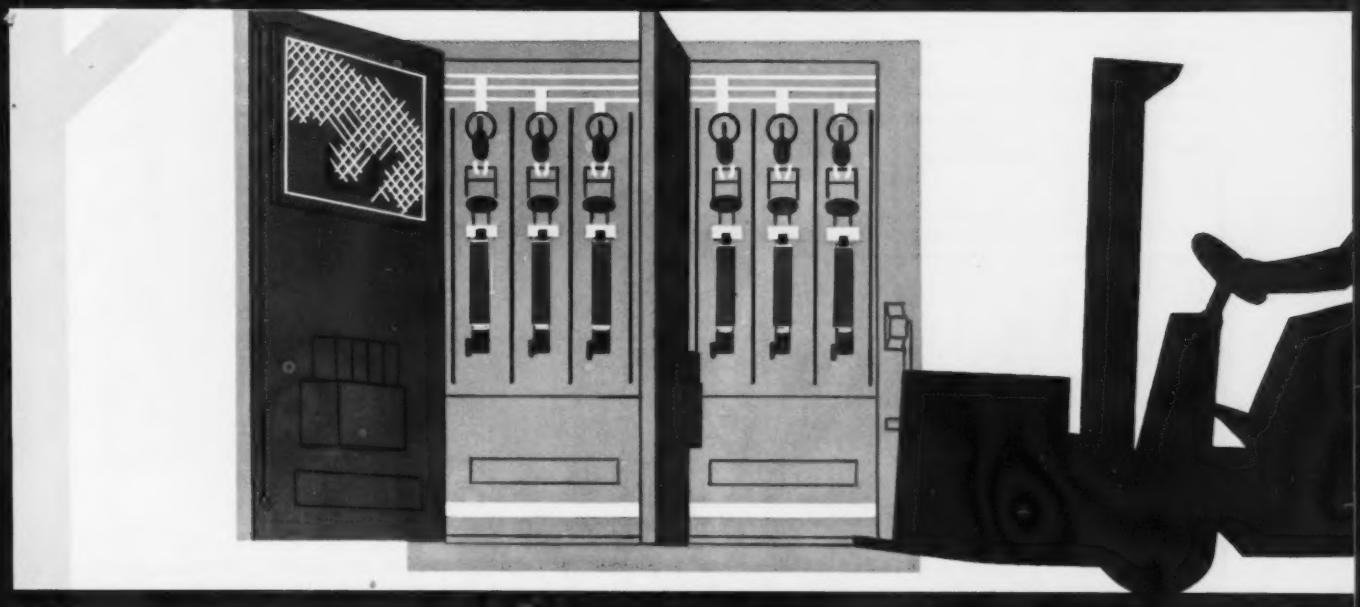
Now you can hang 500,000 kva on a wall with S&C's line of high-voltage metalclad fuses. These compact units conserve valuable floor space while providing fully adequate high-voltage fault protection on industrial and commercial power circuits.

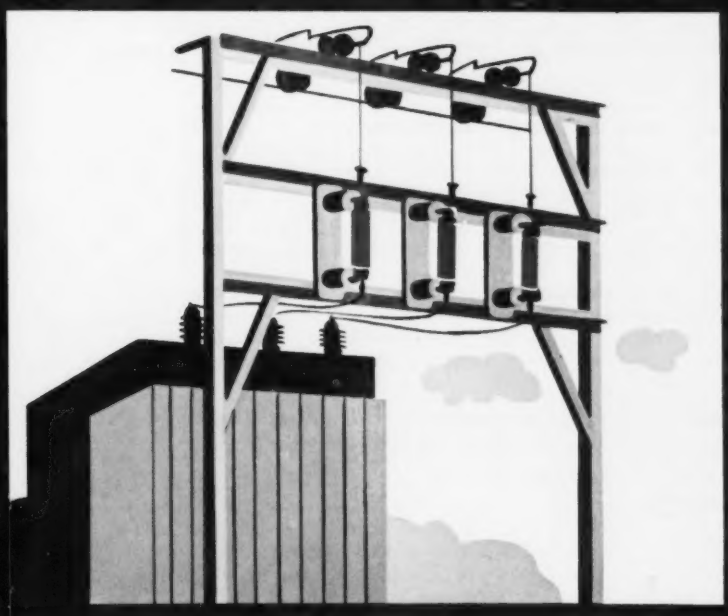
IN VAULTS

Newest addition to S&C's metalclad fuse line is the submersible style for use in vaults or basements where flooding is a possibility. Rated at 4.8 and 14.4 kv, these units carry 200E or 400E amperes continuous, and have interrupting ratings up to 500,000 kva.

IN PLANTS AND BUILDINGS

Power fuses, combined with load interrupters and packaged as S&C Metalclad Switchgear, cut protection costs in half by replacing circuit breakers. Power fuses provide needed protection against permanent destructive faults encountered on industrial and commercial high-voltage circuits. (Load interrupters do the switching.)





IN SUBSTATIONS

The 1,000,000 kva interrupting rating (at 34.5 kv) of S&C's Type SM Power Fuse has made it first choice for protection of large power transformers in distribution substations. This means low-cost, maintenance-free protection against primary and secondary faults, without main line outages.

ON POLES

S&C power fuses can be pole-mounted for line sectionalizing, fusing distribution transformers where short-circuit currents are unusually high, and protecting distribution feeders. Low energy arc-extinguishing action reduces exhaust blast hazards to tolerable limits for linemen and the public alike.

S&C power fuses

50/60 CYCLE SHORT CIRCUIT INTERRUPTING RATINGS OF S&C TYPE SM POWER FUSES

In Amperes, Rating Is RMS Asymmetrical—In Kva, Rating Is Symmetrical 3-Phase on Basis of Asymmetry Factor 1.6

Nominal Rating, Kv		SM-4 REFILL UNIT						SM-5 REFILL UNIT					
Fuse	System	SM-4D INDOOR HOLDER (with Sneezer)		SM-4B INDOOR HOLDER (with Muffler)		SM-4 OUTDOOR HOLDER (without Sneezer or Muffler)		SM-5D INDOOR HOLDER (with Sneezer)		SM-5C INDOOR HOLDER[1] (with Muffler) Caution—See Note		SM-5 OUTDOOR HOLDER (without Sneezer or Muffler) Caution—See Note	
		Kva	Amp	Kva	Amp	Kva	Amp	Kva	Amp	Kva	Amp	Kva	Amp
4.16	2.4									150 000[2]	60 000	150 000[2]	60 000
	2.4/4.16 GrY									250 000[2]	60 000	250 000[2]	60 000
7.2 (7.5)	2.4	45 000	17 500	72 000	27 500	72 000	27 500	90 000	34 500	.....	44 500	.....	44 500
	2.4/4.16 GrY	80 000	17 500	125 000	27 500	125 000	27 500	150 000	33 500	200 000	44 500	200 000	44 500
	4.8	90 000	17 500	144 000	27 500	144 000	27 500	156 000	30 000	225 000	43 500	225 000	43 500
	7.2	115 000	15 000	195 000	25 000	195 000	25 000	195 000	25 000	325 000	41 500	325 000	41 500
14.4 (15)	7.2	115 000	15 000	195 000	25 000	195 000	25 000	195 000	25 000	300 000[2]	40 000	300 000[2]	40 000
	4.8/8.32 GrY	135 000	15 000	225 000	25 000	225 000	25 000	225 000	25 000	350 000[2]	40 000	350 000[2]	40 000
	12	195 000	15 000	260 000	20 000	260 000	20 000	300 000	23 000	500 000[2]	40 000	500 000[2]	40 000
	7.2/12.47 GrY	200 000	15 000	270 000	20 000	270 000	20 000	310 000	23 000	500 000[2]	40 000	500 000[2]	40 000
	7.62/13.2 GrY	200 000	14 000	285 000	20 000	285 000	20 000	325 000	22 500	500 000[2]	40 000	500 000[2]	40 000
	13.8	210 000	14 000	300 000	20 000	300 000	20 000	340 000	22 500	500 000[2]	40 000	500 000[2]	40 000
	14.4	220 000	14 000	310 000	20 000	310 000	20 000	350 000	22 500	500 000[2]	40 000	500 000[2]	40 000
23	7.2/12.47 GrY	.....	12 500	.....	20 000	.....	20 000	.....	20 000	.....	32 000	.....	32 000
	14.4	.....	12 500	.....	20 000	.....	20 000	.....	20 000	.....	32 000	.....	32 000
	23	250 000	10 000	375 000	15 000	375 000	15 000	435 000	17 500	750 000	32 000	750 000	32 000
34.5	23	.....	10 000	.....	15 000	.....	15 000	.....	17 500	.....	28 000	.....	28 000
	27.6	.....	8 800	.....	12 500	.....	12 500	.....	16 300	.....	28 000	.....	28 000
	34.5	280 000	7 500	375 000	10 000	375 000	10 000	560 000	15 000	1000 000	28 000	1000 000	28 000

1. Available only when furnished as an integral component of metal-clad switchgear, constructed in accordance with Data Sheet 605-1 and 605-2.

2. Nominal rating.

OUR GOLDEN JUBILEE

For additional information on S&C power fuses, contact your local S&C representative or write to:

S&C ELECTRIC COMPANY
4435 Ravenswood Ave. • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911

MARKET DEVELOPMENT

Northwest Public Power Assn. Power Use Workshop officers for 1962 met following the three-day meeting in Forest Grove. Left to right: Harry Sherman, light superintendent, Forest Grove, Ore., chairman; Joe Dressel, manager, consumer services, Klickitat County PUD, Goldendale, Wash., vice chairman; and Jim McKinnon, power use specialist, Kootenai REA, Coeur d'Alene, Idaho, arrangements chairman for the 1962 workshop

NWPPA Holds Power Use Workshop in Forest Grove

"How to change the destiny of our area" was the theme for the Northwest Public Power Assn.'s Power Use Workshop, held at Forest Grove, Ore., Sept. 6-8. Some 110 attended the sessions, chaired by Lacy Peoples, Cowlitz County PUD, section chairman.

Brainstorming sessions, a popular innovation at last year's workshop in Longview, Wash., were continued in the 1961 meeting. Topics were selling, competition-substitute services, youth programs, wiring.

The Electrofarm program, sponsored by TVA, was described by G. D. Munger, chief, Electrical Demonstration Branch, TVA, keynote speaker for the conference. Stating that the program means to the farm what the Gold Medallion means to the home, Munger said that home economists and agricultural engineers from cooperating agencies help rural families plan improvements for home and farm. When the family draws up a plan and agrees to follow it, as its budget permits, the farm is designated an Electrofarm and receives a sign. This is a long-range program, he said, and it may take the farmer several years to hit his goal.

Munger also reported on load building programs on electric heating, all-electrical schools and appliances.

Promotional rates that are psychologically sound can make the job of selling much easier, but can become a real problem where they are not psychologically sound, it was pointed out by E. Louis Towne, West Oregon Electric Cooperative, in the panel on selling. As an example, he cited the three-part irrigation rate, which he said is basically good but is not easily understood and therefore has resulted in a certain amount of friction between consumers and suppliers.

A program to teach young people the merits of public power was urged by C. V. Rupp, Yellowstone Valley Electric Co-op, in the panel on youth programs.

Policy on demand metering was covered by Glen Sawyer, Lane County Electric Co-op, and Ken Crow, Grant County PUD. Citing experience when the co-op lowered tariff on commercial business from approximately double the residential rate to only 20% above it (revenue loss in three years was about $20,000 annually with little or no effect on public relations) Sawyer gave these do's and don'ts: Never decrease one schedule if there is any possibility that it will force the increase of another; don't ever install a demand meter for the sole purpose of increasing revenue; don't base your reasoning on someone else's experience; remember that rate reductions, without demand meters, can be no better than rate increases with demand meters; if the people you serve are not behind you because they lack the information, frank discussion will disclose whenever there is a reason for a rate revision.

Crow outlined a recent rate change in his area, made after a detailed study, which he said had brought good customer reaction.

Discussing Bonneville's reactivated power utilization program, W. A. Galbraith, BPA power utilization specialist, said it seems reasonable to predict that within ten years most homes in the Pacific Northwest will be equipped with 200- to 300-amp entrance boxes and will be consuming from 15,000 to 25,000 kwh. In the next ten years loads in the area will double as a result of good promotional load building programs, he said.

Area development, gas competition, public relations in the space age, how to deserve a good press, how to plan, conduct and appraise a power use program were other topics discussed.

The next meeting will be in Coeur d'Alene, Idaho.

► **Waste King Corp.** has announced a $1,000,000 advertising and sales promotion program for the fiscal year ending March 1962. The drive will spread across the entire product line including waste disposers, dishwashers, ranges and commercial equipment.

► **The Moore Co.** has been appointed distributor for Packard Bell radios and TV in the Portland area. Owned by George M. Miller, the firm has moved to new headquarters at 1211 N.W. Glisan St. Dean Muckle and Don Ryan will handle sales.

► **Step Into a Bright New World** is the title of G-E's 32-page booklet outlining the comfort and convenience of all-electric Gold Medallion homes. The booklet, which takes the reader from room to room, may be secured for 15c from General Electric Co., New Concord, Ohio.

22

No need to order, store, and issue 22 different items for a cable joint – G&W furnishes everything you need for a cable splice in one complete package!

Ask your G&W representative for further details or write:

G&W

G&W ELECTRIC SPECIALTY COMPANY
3506 WEST 127th STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFR. • POWERLITE DEVICES, LTD.
TORONTO, MONTREAL & VANCOUVER

Superior quality standards—inspired specialized design

J61-3

OUTSTANDING ELECTRICAL INSTALLATIONS in commercial buildings are being awarded an all-electric merit plaque by the Los Angeles Department of Water & Power. The bronze plaque to be installed in an entrance or lobby as the hallmark of an all-electric building is shown here by Chester B. Little, left, manager of commercial sales, and Robert H. Cockfield, general sales manager for the department. More than 50 commercial buildings completed in the area recently are all-electric, Cockfield said, and many of the multi-storied, high-rise buildings now under construction will be eligible for special merit award recognition. Smaller buildings, too, are going all-electric, he said

Progress Report

Natural gas appears to be making more inroads against oil heat than electric heat in the Eugene area, Byron Price, superintendent, reported to the Eugene Water & Electric Board. He noted that of 629 homes built in Eugene since January only 37 were heated by natural gas.

In a breakdown for June, his figures showed that, of 135 new homes, 115 had electric heat, 12 natural gas and eight oil.

Eugene has had natural gas since September 1960.

► **Ford Motor Co. plans to enter the appliance and electronic fields** by purchase of Philco Corp. Under a proposed agreement, one share of Ford common would be given for each 4½ shares of Philco common. Philco's preferred stockholders would receive shares of Ford common equal approximately to $101.50 for each preferred share. It is estimated that the deal will require more than one million Ford shares.

► **J. B. Williams Co.** has acquired **Landers, Frary & Clark,** manufacturer of electrical appliances under the Universal and Universal Handy Hannah DeLuxe trademarks.

Keeping line clearance costs DOWN goodwill UP

Proven power equipment and Davey trained rope climbers . . . that's what makes Davey Surgical Line Clearance so economical. Utilities can rely on the dependable, efficient, and *adaptable* Davey crew. It will pay you to talk over your tree maintenance problems with the West's leading line clearing specialists—Call Davey.

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TREE SURGERY CO., LTD.
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ELECTRICAL ENGINEERS

Constant innovations in already complicated construction make Estimating a distinct and exacting profession, requiring constant research. There can be substantial difference in cost between two apparently similar projects.

Thus, more and more owners, architects and engineers are using our estimating service. It includes:

1. Preliminary estimates to keep building costs within budgetary limits.
2. Comparative costs of alternative designs, materials, equipment, systems, schemes, etc. as an aid in selecting the materials, etc. most suited to each project.
3. Final cost estimates, the quantities of which may be furnished as an aid to bidders or as a basis of fair competition.
4. Cost estimates of desired changes during construction.
5. Checking of contractor's estimates of work in support of partial payments.
5. Construction cost counselors from beginning of preliminary plans to final completion of project.

Ask us for complete details of our estimating service for Electrical Engineers.

LeRoy Construction Services

768 Brannan Street San Francisco 3

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New Products

► **A dishwasher,** first of what is planned as a white goods line, is offered by Ling-Temco Electronics. Redesigned from a model made by James Industries, the washer can be mounted above, below or on the counter, or installed in the wall. The unit uses a "wall-of-water" technique instead of the conventional spray or lawn-sprinkler action. A motor-driven impeller blade hurls a cascade of water—about 100 gmp—against the dishes, which later get a 12½-minute steam bath. Motor, pump and electrical gear may be removed in one compact module for maintenance. Suggested retail price runs from $199.95 to $279.95, the largest model taking 15 place settings.

► **Featuring oscillation for even heat distribution,** Martin's new Oscilectric room heater is designed for instantaneous heat, maximum efficiency and longer life. The curved chrome reflector beams the heat outward over an arc of approximately 180° to do away with hot spots and cold areas. The motor drives the blower fan and gently oscillates the reflector, spreading radiant heat over the room. A control switch in the rear allows the motor to be cut off and the heater used as a fixed radiant type unit. Other features listed by the manufacturer are positive-action thermostat, five-year guarantee against burn out of heating element, safety mesh grill and safety tip switch that automatically shuts off the current if the heater is tipped or knocked over. List price is $39.95.

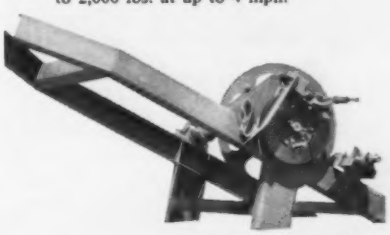
► **A new model Instant Heetaire** introduced by Markel Electric and La Salle Products has a 170-sq-in. heat chamber engineered to beam wide heat rays throughout a room. It features a safety-gravity switch to turn off the unit if it is tipped or overturned and assures operation on the roughest surfaces, the manufacturer states. The unit has push-button controls and temperature is maintained automatically by a built-in thermostat. Available in a choice of 1,320-w or 1,650-w models, the unit lists for $29.95.

► The Night Lighter, a new electric wall **clock with a built-in night light,** has been made available by Sunbeam Corp. Requiring no switch or other controls, a soft glow is supplied by the patented Panelescent panel behind the transparent dial. Retail price is $9.98.

Now—Convert your own Reel Dolly to a Bullwheel Tensioner WITH A PENGO 5000-U Assembly

5000-U assembly installed by City of Medicine Hat, Alberta, Canada

Here's an easy way to build up a modern bullwheel tensioner at low cost—simply install a PENGO 5000-U Bullwheel Assembly to your old trailer or reel dolly. You'll have a tensioner with Neoprene-lined 26" bullwheels, capable of handling practically any distribution line stringing job at tensions to 2,000 lbs. at up to 4 mph.



Support arms, reel spindle with reel brake, and hand rewind assembly. 2⅜" spindle will handle reels to 75" diameter, 44" width unless reduced to fit your trailer.

Bullwheel and tension brake assembly may be purchased separately.

We invite you to write or wire for literature, prices—please address Dept. 34.

PETERSEN ENGINEERING COMPANY, INC.

Santa Clara, California

16 **Phone: AXminster 6-7712**

When Hot Line Taps are Subject to Change

Protect Conductor with Chance Tap and Bail Clamp Combinations

Where jumpers or apparatus hot line taps are temporary or subject to change, these Tap and Bail Clamp Combinations are being widely used to avoid main line "punishment." Chance Snap-on Bolted Bail Clamps or Right Angle Compression Bails permanently installed on the main conductor permit one or two clamp connections to be made on the bail wire. Any arcing that occurs when the tap is connected or disconnected is confined to the bail.

Snap-on spring action and contact guides facilitate installation of the Bolted Clamp. The right angle of the Chance Compression Bail aids installation with compression tools and gives easy accessibility from the pole for tap installation.

To make extra certain that you get a good connection, the contact grooves on all Chance Bail Clamps are filled with z.l.n. 100 Electrical Contact Aid. Bails are available in either aluminum or cadmium-plated copper.

CC61-24A

A. B. CHANCE CO.
CENTRALIA, MISSOURI
A. B. Chance Co. of Canada, Ltd., Toronto

NUCLEAR NEWS

Uranium Mills

The AEC exercised its option to extend the term of the contract with Kerr-McGee Oil Industries Inc., covering production from the Shiprock, N. M., processing mill, from June 30, 1965, to Dec. 31, 1966, with no increase in the over-all commitment for the purchase of U_3O_8 in concentrate.

With this action there are now five uranium mills having contracts with the commission extending through 1966 that provide for the purchase of eligible ore from independent producers of uranium-vanadium ores.

New Vallecitos Reactor

The AEC has issued a construction permit to the General Electric Co. authorizing construction of an Experimental Superheat Reactor at the company's Vallecitos Atomic Laboratory near Pleasanton, Calif.

The Experimental Superheat Reactor is designed as a developmental and test facility to be employed principally to irradiate developmental superheat fuel elements. It will be constructed adjacent to the existing Vallecitos Boiling Water Reactor and ultimately is intended to superheat steam produced in the VBWR. The experimental superheat reactor is designed to operate at a thermal power of 12,500 kw.

Nuclear Power Plant

San Diego Gas & Electric Co. announced its intent to participate with Southern California Edition Co. in the procurement and operation of its nuclear-fueled generating station to be located on a site approximately midway between the Los Angeles and San Diego load centers. The San Diego utility's share in this project will be approximately in proportion to the system loads of the two utilities—about 20%.

The intended development of a full-scale nuclear plant by these two neighboring utilities is dependent upon the consummation of a mutually satisfactory agreement covering the many legal, financial and technical arrangements, including the necessary authorizations and permits from governmental bodies required for the construction and operation of such a plant.

The nuclear power plant will consist of a Westinghouse closed-cycle water reactor with auxiliary equipment necessary to supply steam to a 375,000-kw (e) turbogenerator. A conventional switch yard and transformers will permit transmission of the energy to load centers at 220 kv.

Direct Conversion

First operation of a high-temperature device that converts heat from conventional fuel directly into electricity was announced by Atomics International, a division of North American Aviation Inc.

A flame-heated thermionic generator, it burns a mixture of propane and air. It is the first time conventional fuels have been successfully used to obtain the high temperatures required to operate an efficient thermionic converter.

The generator was developed by Atomics International as part of a company-sponsored program to explore new methods of power conversion. The direct conversion unit resembles a metal radio tube and is a typical "cesium vapor diode." This type of converter is capable of achieving high efficiency and high power. Its successful operation using conventional fuels demonstrates the feasibility of developing compact, lightweight, silent power systems for a variety of practical applications.

Dismantling SL-1

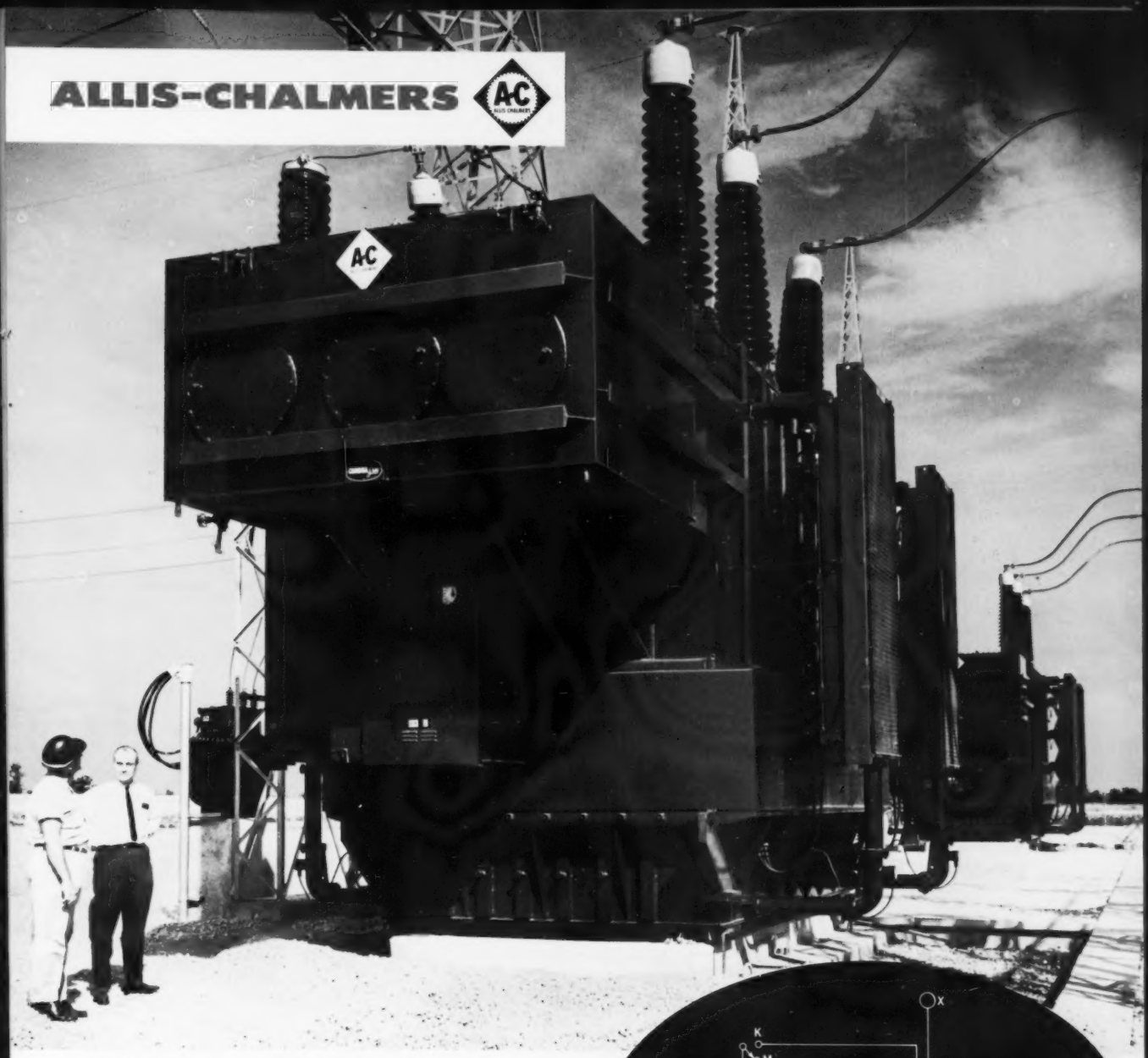
The special advisory committee appointed by A. R. Luedecke, general manager of the AEC, to consider the future use or disposition of the Stationary Low Power Reactor No. 1 (SL-1) in Idaho, has concurred in proposals for decontamination of the reactor building and dismantling of the core. The SL-1 was the reactor involved in the accident that occurred on Jan. 3, 1961, at the National Reactor Testing Station in Idaho.

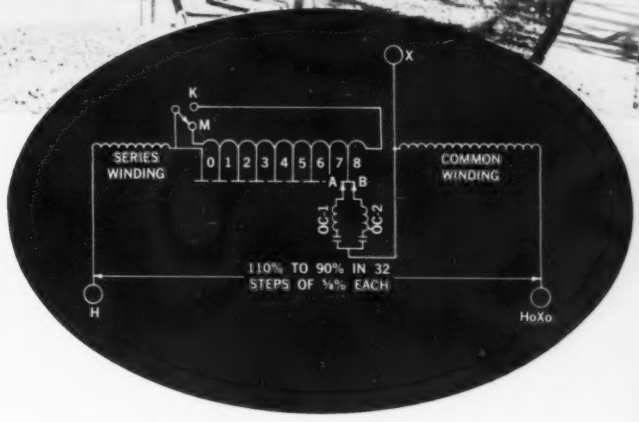
USE ELECTRICAL WEST's
annual
MANUFACTURERS' DIRECTORY

Published in December 1961 as a handy reference and guide. It is the only directory of Western sources for electrical products and includes:

Directory of Manufacturers
Where-to-Buy Products Directory
Directory of Representatives

ALLIS-CHALMERS





Now available from Allis-Chalmers only... Line-End *load tap changers for ratings up to 230 kv and above*

With the growing number of interconnections requiring high-voltage and extra-high-voltage autotransformers, utility engineers have long been seeking a more efficient, lower cost LTC mechanism.

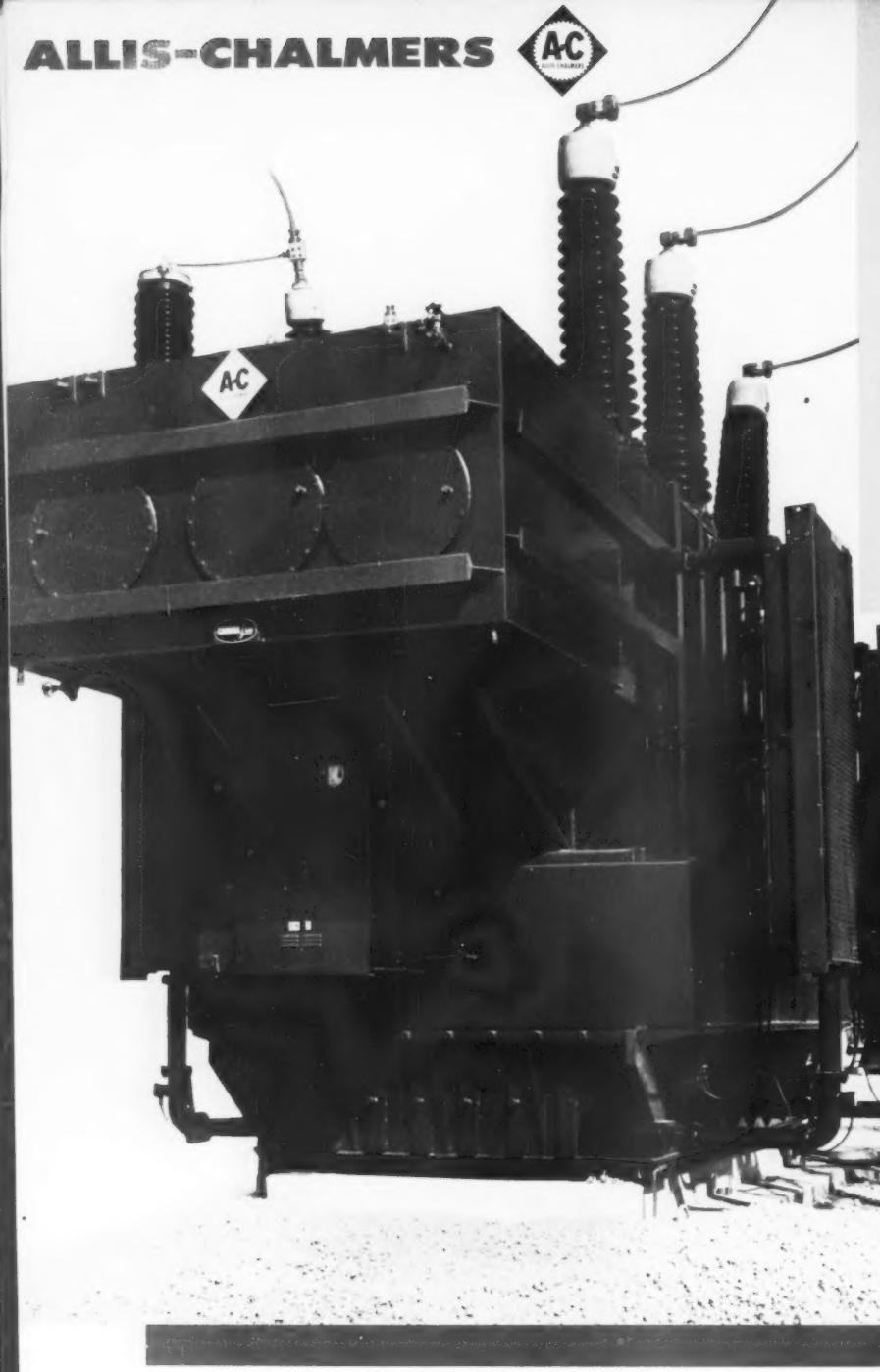
As far back as 1928, Allis-Chalmers supplied a bushing-mounted mechanism but abandoned it in favor of the less complicated though bulkier series transformer design.

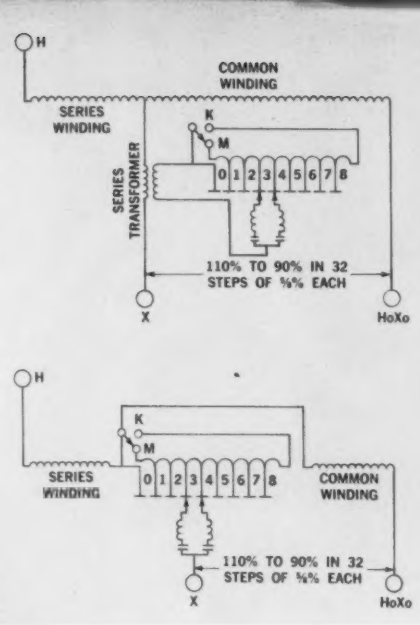
Now, in the new LINE-END tap changer, Allis-Chalmers offers the utility industry the best of both approaches. The LINE-END design is reliable and simple — proved dependable in two years' operating experience . . . with over 1,600,000 kva installed on commercial systems. In addition, by eliminating the need for a series transformer, A-C offers savings in size and weight . . . plus lower losses and increased efficiency.

A-1540

For the facts on this new approach to LTC, turn the page . . .

ALLIS-CHALMERS





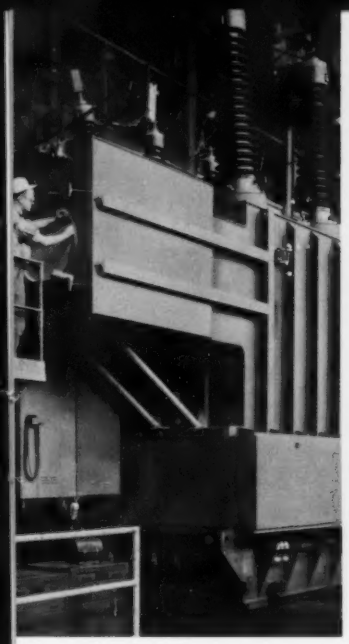
Contrast the circuit diagrams—one using a series transformer (above), the other with the LINE-END tap changer (below).

Two 180,000-kva Allis-Chalmers autotransformers with LINE-END tap changing installed at Public Service Co. of Indiana's Five Points substation.

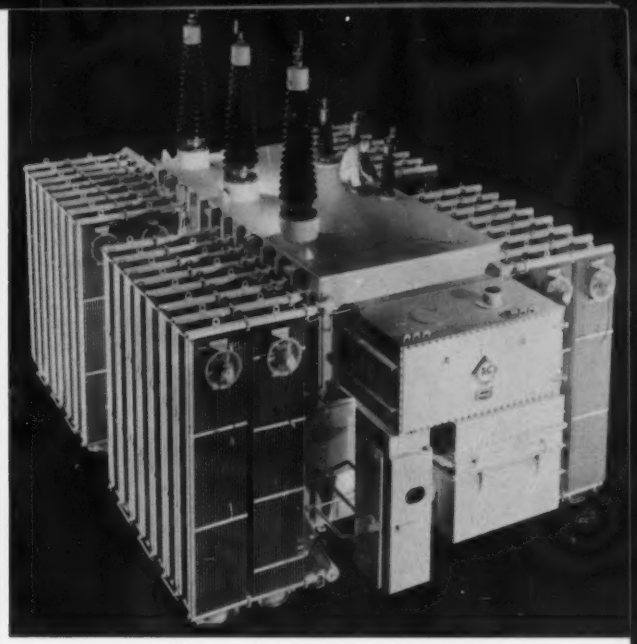
Compare these two 50/83-mva autotransformers installed at the Central Power & Light Co. within a few months of each other.

Characteristic	Series Type	LINE-END	% Improvement
Total Weight (lb)	316,000	246,000	22%
Floor Space (sq ft)	700	570	19%
Total Losses (kw)	208	166	20%

Rated 138/69 — 12.5 kv, with ±10% LTC in 69-kv circuit



Access ports are easily reached on A-C autotransformers with LINE-End tap changers. View through port displays rugged yet simple current-interrupting contactor and barrier bushing.



LINE-END tap changer is also applicable to delta windings. This 250-mva transformer is shown prior to shipment to a major West Coast utility.

20% smaller...20% lighter

LINE-END load tap changers offer 15% average lower losses

Combining its 37 years of building load-tap-changing equipment with famed corona-free design, A-C has developed for the industry a line of tap-changing equipment in sizes 50,000 kva and larger through the extra-high-voltage range.

BY ELIMINATING THE SERIES TRANSFORMER — the LINE-END tap changer accomplishes the following (see also table at left):

Lower losses — *an average of 15% less* — with consequent increases in efficiency — and the added bonus of stabilized tertiary voltage.

20% less floor space — Compact design fits existing substations. For new sites, savings in real estate, pad, overhead structure can be realized.

20% lighter — One-piece shipment with permanent cover in place is now possible for larger units. Attendant economies in time and labor for field assembly are great . . . as are the cost reductions in moving transformers from railroads to substation sites.

BY LOCATING THE DIRECT-ACTION MECHANISM ON THE MAIN TANK, the LINE-END tap changer provides the following economies:

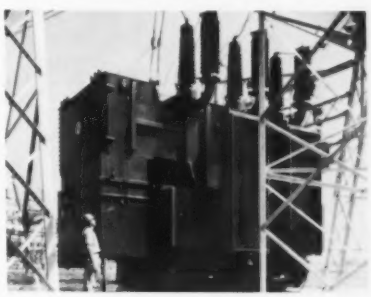
Simplicity adds reliability — Absence of several long shafts and sets of bevel gears makes mechanical synchronization of three phases far simpler. Only two shafts, both straight, are required on the direct-action LINE-END mechanism.

Sharply reduced maintenance — only one seal to maintain. And the mechanism is easily accessible at main tank height.

Greater safety — No need to use ladders on top of the transformer for routine inspection and service.

Utilizes standard bushings — Replacement can be made from stock. Hence no special bushing inventory is required.

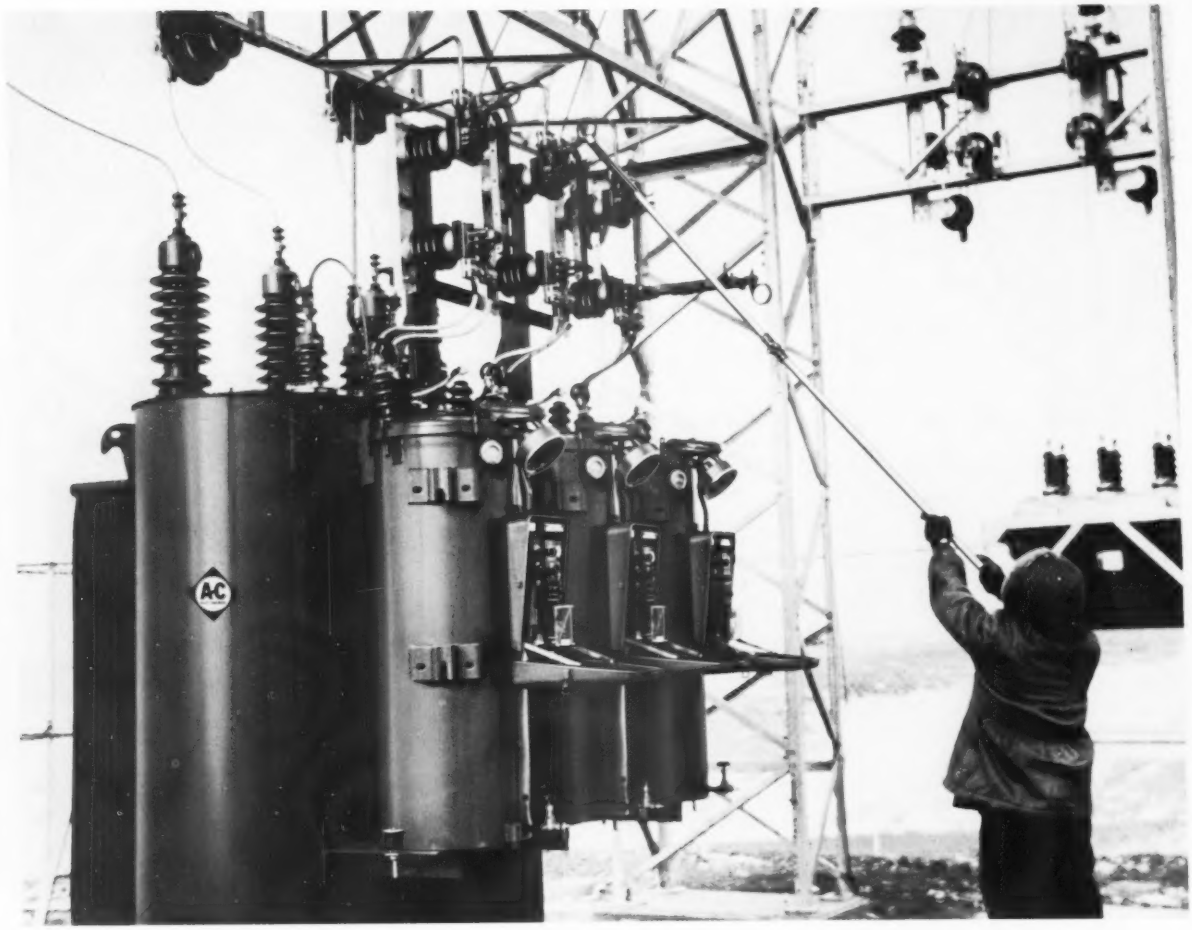
For Bulletin 01B1052, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



On the lines of a Texas system — a 200-mva, 132/66-kv autotransformer with LINE-END tap changer. This company also has a 100-mva LINE-END-equipped unit.

ALLIS-CHALMERS

ALLIS-CHALMERS



Now! Safe by-pass of regulation equipment

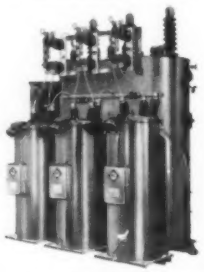
No service interruption with new Regu/Tran units

Hook-stick-operated for maximum personnel safety . . . all by-pass switch operations are performed in proper sequence. All three switches are fully visible from a single vantage point. Each by-pass switch opens both leads to the series windings . . . interrupts exciting current . . . *without interrupting the load.* Locks securely — eliminates any danger of accidentally dropping load.

These versatile switches are just one example of *Regu/Tran* unit flexibility. This unique, integral assembly offers true independent phase regulation. The three single-phase regulators improve voltage control, increase revenue. It's the economical answer to the problem of unbalanced loads and varying lengths of single-phase feeders.

- **MINIMUM INVESTMENT**—Buy Regu/Tran transformer first. Add regulators, by-pass switches as you need them.
- **TAILORED REGULATION** — If just ±5% regulation is needed, that's all you purchase. No need to pay for unused voltage range.
- **VERSATILITY** — Use transformer or regulators as separate units.

More Regu/Tran *unit facts? Call your nearby A-C office or write* **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*



Regu/Tran is an Allis-Chalmers trademark. A-1441

ASSOCIATION AFFAIRS

PCEA Panorama

In establishing the program for the PCEA during his administration, President H. G. Dillin announced the following:

The year's activities of the **Engineering and Operating Section** are under the supervision of the guidance committee of which H. S. Warren, Rome Cable Division, Alcoa, is chairman and H. R. Daniels, PG and E, is vice chairman.

Sponsors of groups in this section include: **Communications**—L. E. Ludekens, So. Calif. Ed.; **Engineering Design** – Paul E. Roosenberg, San Diego G&E; **Hydroelectric** – R. T. Enloe, So. Calif. Ed.; **Meters**—Merle H. Atcheson, Sierra Pacific Power; **Overhead Transmission and Distribution** – L. M. Guibara, Kaiser Aluminum & Chemical Sales; **Steam Generation** – Paul E. Christman, G-E; **Substations**—C. Keith Grant, Calectric; **System Operation** – Kenneth K. Bradley, PG and E; **Transportation**—J. R. Golden, Arizona PS; **Underground Transmission and Distribution** – Jack H. Lawson, PG and E; **Hotel Arrangements** – Vern S. Cooper, G-E Supply; **Program**—(Cosponsors) W. L. Moats, Westinghouse, A. W. Jensen, Industrial Engineering & Equipment Corp.; **Props and Equipment** – C. E. Muller, Allis-Chalmers; **Registration** – C. M. Hutchinson Jr., Kortick Mfg. Co.

The preceding groups and committee heads will be assisted by an advisory committee consisting of the five most immediate past chairmen of the section. These are: G. R. Best, G-E; R. L. Brinton, PG and E; J. H. Drake, So. Calif. Ed.; K. M. Bausch, Bechtel Corp.; W. J. Johnson, Calectric.

For the **Business Development Section,** the guidance committee consists of the chairman and vice-chairmen previously named for the 10 committees within that section.

There is also an advisory committee for this section composed of: G. F. Blake, Rome Cable Division, Alcoa; J. C. Chamberlain, San Diego Bureau of Home Appliances; D. S. Aiken, PG and E; Jack Kaidaisch, Arizona PS; J. A. Corlett, G-E.

Since the conferences of the **Administrative Services Section** are sponsored jointly by the PCEA and the Pacific Coast Gas Assn., their planning and supervision are the responsibility of both organizations.

In the PCEA, the activity is headed by D. M. Pritchett, California Pacific Utilities, chairman; P. H. Murdoch, So. Calif. Ed., vice chairman.

For the PCGA are E. F. Hawkesworth, Southern California Gas; John L. Holleran, Southwest Gas.

The sponsors of the fall conference are: **Accounting** – Klaus Bachenheimer, Southwest Gas; **Land and Right-of-Way** – E. T. Cleaver, San Diego G&E; **Legal**—Milford Springer, Southern Counties Gas; **Systems and Methods** – D. K. Traverse, So. Calif. Gas.

President Dillin also has announced the appointment of J. F. Sinnott as the general chairman for the 1962 convention. A vice president-engineering of San Diego Gas & Electric, he is now preparing the list of those whom he will ask to serve as committee chairmen.

As previously reported, the convention will be held at the Ambassador Hotel in Los Angeles on May 16 through May 18.

► **Sacramento Valley Electric League** officers for the year beginning in September have been elected. Myles Myers, A-1 Appliance, is the new president; Richard Taylor, Graybar Electric, vice president; Harry O'Laughlin, Sacramento Municipal Utility District, is secretary-treasurer. For the Electrical Construction Section John Pineau, NuTone Inc., is chairman and Jack Cook, Capital Wholesale Electric, is vice chairman.

► Reappointed were all members of the **Idaho State Electrical Board** by E. R. Hopper, commissioner of the Department of Law Enforcement. They are: Henry F. Koch, Boise, four years; M. E. Shotwell, Twin Falls, four years; Ward D. Hall, Pocatello, three years; J. Keith Lott, Rupert, three years; John W. Nanninga Jr., Lewiston, two years; Ken Evgen, Coeur d'Alene, two years; and Charles W. Bateman, Idaho Falls, one year.

► **Electric Club of San Mateo County** elected new officers for the year at its August meeting. Darrell Teachout, Richmond Electric Co., was elected president; William Breckenridge, San Mateo County electrical inspector, vice president; Louis Rolla, Coast Electric Co., secretary-treasurer, and directors are Art Gingell, past president; Ira Allen; W. H. Diederichsen; Robert Coleman, and William Hilton.

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ELECTRICAL WEST
VOL. 127, NO. 4 OCTOBER 1961

PROGRESSIVE STANDARDS—II

Distribution transformer manufacturers have recently established 65 C temperature rise as the basis for kva rating. **This is a break with standards.**

In an earlier editorial (EWEST, December 1960), we suggested that this action would offer a saving to users of about 4% in total transformer costs. It did.

Concurrently, our Western Underground Committee has established a standard for 12-Kv pad-mounted transformers. By agreeing among themselves, they can form a pattern around which manufacturers can work to reduce the number of designs—hence, costs. This is the first pad-mounted standard in the country. **In this effort to make a standard, we commend them.**

These two examples make clear the point that standards in themselves are neither good nor bad. They are good if they bring uniformity and, as a consequence, reduced manufacturing and operating costs. They are bad if this uniformity denies use of up-to-date materials and techniques. The 55 C rise was established in 1913. That's archaic! A manufacturer reports over 300 separate customers' designs for pad-mounted transformers. Ridiculous!

Lunch talk has it that the jump to 65 C could have been undertaken years ago with conventional insulations. If this is so, deadhead standards have cost many millions.

What's needed is **progressive standards.** Standards that are alive. Standards that sit still long enough to make possible manufacturing savings but still have the latent vitality to goad manufacturers into using new and better methods.

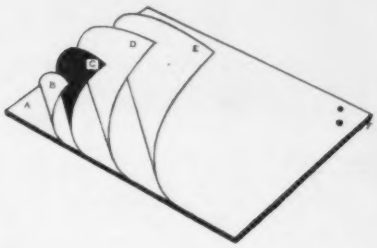
Let's place the blame. It's with you, my utility friend. You guys with your name on the door and a rug on the floor. Progressive standards will never come to pass unless you make them.

We are not suggesting that manufacturers not be a party to the standards-making process. But we are suggesting that the leadership should come from the users. Surely today's standards-making processes favor a lowest common denominator of technical excellence. And they are too slow. A manufacturer with a better product faces the onus of "breaking the standards" if he desires to bring a better product to his customers.

The solution is a long way off, and will not come to pass until each major utility has one of its most capable engineering managers staffed and dedicated to the work of progressive standardization.

Until this comes to pass, we can't help but feel that an important prerogative—no, a responsibility—is being neglected by electric equipment users.

Electroluminescent lamp is a sandwich of (a) 22-gage enameling steel, (b) dielectric coating, (c) dielectric ceramic containing the phosphor, (d) transparent conductive tin oxide, (e) protective ceramic glaze. At (f) electrical contacts are made to the tin oxide film and steel plate to charge it



Your New Frontier In Light—

Electroluminescence

Flat light—a laboratory plaything for 10 years or more—is coming out to be put to work at last. Perhaps not fully mature yet, at least it is strong enough to stand alone and make progress on its own.

Electroluminescence is its name—generically. One company uses that monicker plain. Another calls it Panelescent, a third Rayescent. But each is essentially the same—a light sandwich, flat instead of tubular or in a bulb. The sandwich is made up of layers of conducting and dielectric materials on a backing of glass, film or metal. Electrically it is a condenser plate that makes the phosphors of its "meat" slice glow when charged.

But what does it offer the industry in useful application and market—that is the question for which an answer has been long awaited. It is to answer that query that this nonlaboratory look at electroluminescence is pertinent. Is it commercially available? Where and when can it be used? What does it offer? What are its present limitations? How do you install it—feed it—protect it? Is it rugged enough to take rough wear? What future does it hold?

Here are the current answers.

Is it Commercially Available?

Yes, it is. Three major lamp companies say so. One, Sylvania Electric Products, declares that it has already produced more than 12 million of its Panelescent lamps. This company is perhaps the most active in the field of sales and use of these lamps. True, most of them are in the small class. Best sellers are a night light disc that can be plugged in to any 110-v convenience outlet. It is selling in variety stores throughout the world.

Of similar popularity is an elec-

Epoxy encapsulated lamps make a luminous sidewalk or stair treads for the dark

troluminescent switchplate for residential light switches. It glows in the dark to make it easy to find. This, too, because it can be installed with a screwdriver by almost anyone (and has UL listing as safe) is sold in stores everywhere. Sylvania also has been supplying Chrysler cars with luminescent dials and even pointer hands that are tiny Panelescent lamps, run from the automobile's battery through an oscillator.

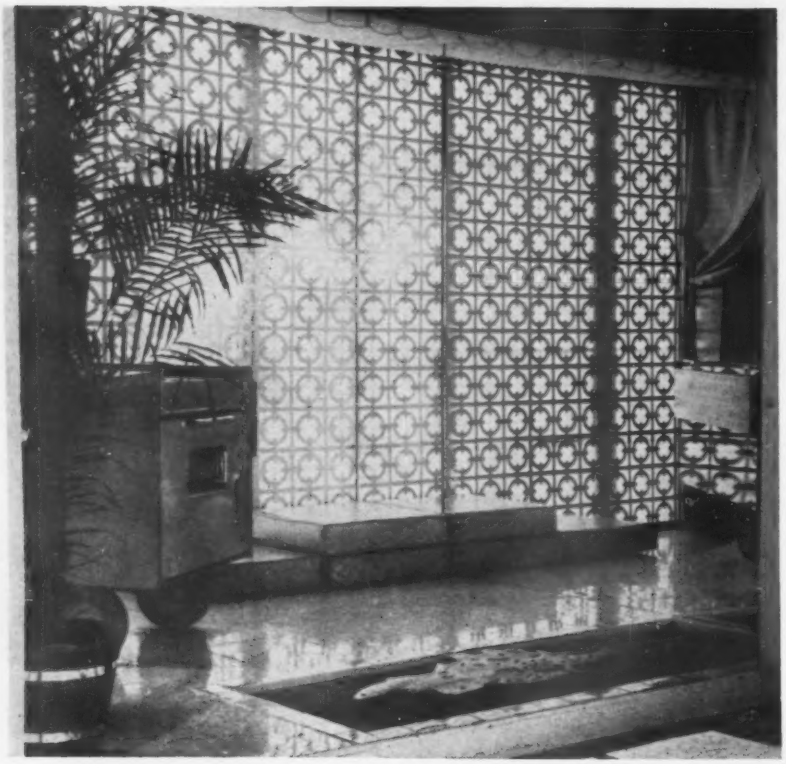
But what about larger commercial applications that can be a potential market for the electrical contractor and supplier? What is available now and from whom?

Westinghouse lists in its catalogs sizes of its Rayescent lamps from 2x2-in. square on up to 12x12-in. square in a variety of modules. These are commercially available on order. For the manufacture of special fixtures or panels it says it can make up lamps in special sizes and shapes to a maximum of 24 in. long. On these legends, data or markings may be silk screened on the glass before processing. Lamps in irregular shapes and with holes or openings can be made within the limitations of glass cutting. Its lamps are made on a glass backing, generally, but it has just announced increased facilities to produce its Rayescent lamps on film, glass or metal.

Film-type lamp stays lighted even when cut with scissors. Road sign lamps stay lighted when pierced by bullets or rocks

Road marker sign on Highway 99, Sacramento, as it appears by day and by night, lighted

Below, one decorative idea, a luminous wall on which a design pattern has been stenciled



General Electric Co., because of the still small light output of the electroluminescent lamp, has not gone into production except to supply special manufactured articles such as clock faces, night lights, dials and instrument panels. (Rather it has brought out a high output square flat lamp by bending a fluorescent lamp to fill a square.) So at present it is not a commercial source of electroluminescent lamps except on a custom or experimental basis. Its present product favors a flexible film-type backing.

Sylvania, however, is taking imaginative strides into larger fields. It is currently producing 1x1-ft modules and can make panels up to 3x5 ft in continuous production. Larger lamps have been made successfully. A lamp 2x8 ft was demonstrated recently by O. Howard Biggs, vice-president-research and engineering, of Sylvania's Lighting Products Division.

Such panels are made on metal, either aluminum or enameling steel, with porcelain ceramic coating and, hence, are very rugged. This company also makes plastic film lamps and glass-backed lamps. However, such success is being had with the metal-ceramic lamps that major emphasis is being placed on this type.

For outdoor signs lamp panels of three sizes on 1-ft modules are made on aluminum backing; waterproofed by encapsulation in tough transparent epoxy. Such metal modules, 1x1 ft in epoxy, have been made into a sidewalk and used on steps at the Sylvania plant to test out the wearing quality of the plates. A very attractive market for luminous sidewalks, marker strips and step treads is foreseen from this type of application. It is something that can be sold and installed right now.

A still more exciting potential may be found in the installation by contractors of such lamps made in linear shape to indicate the off ramps at airports for taxiways. These low brightness area source lamps will be comfortable to the dark adapted eyes of pilots coming in at high speed for a landing and who are required to get off of the landing strip as fast as possible.

Such lamps can be embedded in the pavement in a shallow channel. A field test of such a taxiway is being made at an eastern airport.

What Are Its Present Limitations?

Available commercially now as stock items are the 60-cycle modular lamps mentioned. Special orders for lamps operating at higher frequencies and voltages are custom produced. The brightness of lamps increase with frequency but at the expense of lamp life. Maximum frequency used today is 400 cycles and voltage of 600. Street sign panel lamps are available to operate at 60 cycles, 600-v, which produce a brightness of 5 to 7 foot-lamberts.

The 120-v panel lamps at 60 cycle, draw 0.25 milliamps per sq in. They produce brightness of only .5 to .8 f-l. To get brightness of from 2 to 3.5 f-l on 60 cycle, lamps may be operated on 300 v.

Present commercially available lamps produce either a green or a blue light. The blue is about 20 per cent less bright than green and while other colors may be procured they are less bright than the green. Some colors can be produced by covering the lamp panels with a fluorescent paint, which reconverts the energy into other colored light but it should be remembered that such paints fluoresce in daylight and may appear lighted.

Electroluminescent lamps may be operated on a dimmer and the brightness will change accordingly. However they should not be operated over the voltage rating for which they were built as it would affect lift and output. Higher voltage lamps require heavier dielectric layers, naturally. Ambient temperature has no effect, apparently. Normal life, based on when the brightness decreases by 50%, of the 120-v, 60-cycle lamp, is about 25,000 hours. At higher voltages and frequencies it is much less.

According to Fred Wolfe, marketing manager for Sylvania's Panelescent Division, distribution of the lamps of stock sizes will be made through electrical supply distributors; for signs, through sign suppliers. Highway signs, taxiway strips, marker strip lamps for bridges and highways will go through regular electric supply channels.

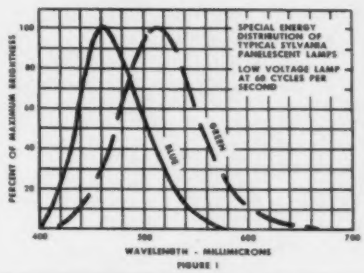
Installation of the electroluminescent lamp is simple. The panels come equipped with pigtails that connect to the two energized layers sealed within the lamp for protection and weatherproofing. Allowance must be made for a nonluminous edge of from ⅛ to ¼ in. around each panel. This is needed to seal and make the electrical connection.

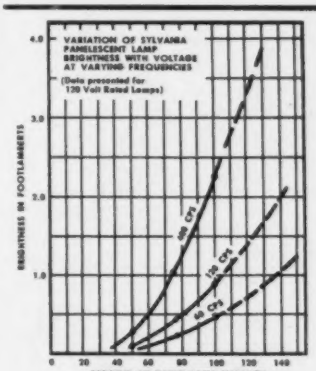
While present light output may be considered too low for much general use and certainly not high enough to produce working levels of illumination even from entire walls or ceilings of these lamps, there are many areas where they can be used decoratively. Where general illumination is low, such as in restaurants or night clubs, decorative luminous panels can be effective. Exit signs in theaters, direction markers or signs in dark areas, and the like, are other possibilities. The luminous sidewalk and stair tread and, in the near future, the highway marker strip, also hold a widening potential market.

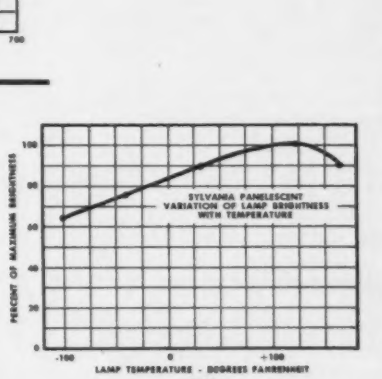
The flat, thin electroluminescent lamp may never replace the bulb or tube but it offers a new field of application that is special and which the others cannot fulfill as well. It extends the frontier of light.

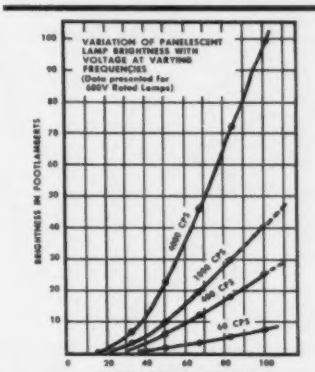
TECHNICAL DATA

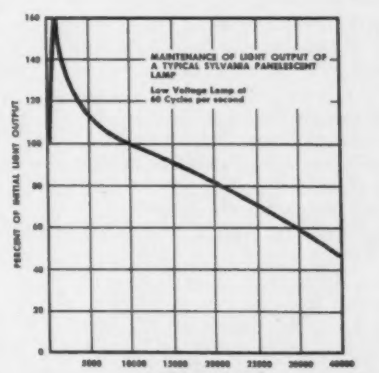
A look at the electrical characteristics of electroluminescent light sources


SPECIAL ENERGY DISTRIBUTION OF TYPICAL SYLVANIA PANELESCENT LAMPS
LOW VOLTAGE LAMP AT 60 CYCLES PER SECOND
BLUE
GREEN
PERCENT OF MAXIMUM BRIGHTNESS
WAVELENGTH - MILLIMICRONS
FIGURE I


VARIATION OF SYLVANIA PANELESCENT LAMP BRIGHTNESS WITH VOLTAGE AT VARYING FREQUENCIES
(Data presented for 120 Volt Rated Lamps)
400 CPS
120 CPS
60 CPS
BRIGHTNESS IN FOOTLAMBERTS
PERCENT OF RATED LAMP VOLTAGE
FIGURE II


SYLVANIA PANELESCENT VARIATION OF LAMP BRIGHTNESS WITH TEMPERATURE
PERCENT OF MAXIMUM BRIGHTNESS
LAMP TEMPERATURE - DEGREES FAHRENHEIT
FIGURE IV


VARIATION OF PANELESCENT LAMP BRIGHTNESS WITH VOLTAGE AT VARYING FREQUENCIES
(Data presented for 600V Rated Lamps)
400 CPS
120 CPS
60 CPS
BRIGHTNESS IN FOOTLAMBERTS
PERCENT OF RATED LAMP VOLTAGE
FIGURE III


MAINTENANCE OF LIGHT OUTPUT OF A TYPICAL SYLVANIA PANELESCENT LAMP
Low Voltage Lamp at 60 Cycles per second
PERCENT OF INITIAL LIGHT OUTPUT
BURNING TIME - HOURS
FIGURE V

SEALED INSULATION SYSTEMS

Offer attractive savings—up to 45%
Applications for petroleum and chemical industries
Careful analysis of field conditions necessary

C. T. GUTLEBEN, INDUSTRIAL SALES, GENERAL ELECTRIC CO., SAN FRANCISCO

Motor insulation systems and enclosures are going through a period of rapid change with the result being that applications previously requiring totally enclosed construction can now be made in many instances by using, in effect, dripproof motors, but with sealed insulation systems and mechanical modifications for outdoor use.

This design trend brings lower costs with equaled and, in some cases, improved motor performance.

In small motors, through approximately 100 hp, the cost difference between moisture-sealed construction and totally enclosed is in the order of 15% saving.

The greatest saving involves motors 125 hp and larger, with 40 to 45% price reductions for using moisture-sealed motors instead of totally enclosed fan cooled. This price difference refers to sizes and types of motors where totally enclosed, fan cooled construction is practical; for instance, induction motors through approximately 2,500 hp, 1,800 rpm. With larger motors, a general price relationship is not possible and comments on this subject will follow.

The petroleum and chemical industries' rapid expansion makes the potential savings attractive. But capital saving at the price of continous production or excessive maintenance is unthinkable. This article covers points that should be considered by the petroleum and chemical users in applying these new design motors —not the whole subject of motor application.

Definitions—Simplified and Unofficial

Division No. 1—Hazardous Area—The ambient can be at any time or continuously explosive, and explosion-proof devices are required. If the device breathes (i.e., a motor), the enclosing case must be strong enough and have long enough fits so that the internal explosion will not transmit to the ambient area. The device can be hermetically sealed (i.e., a mercury switch) so that the explosive ambient never enters the device.

Division No. 2—Semihazardous Areas—The ambient is normally nonhazardous and only becomes hazardous upon a process upset, or mechanical equipment failure. In Division No. 2 areas, the code allows nonexplosion-proof electrical equipment *provided* it has no normal arcing contacts. The idea is that the chance of having a mechanical failure at the same time as an electrical failure is extremely remote.

Totally Enclosed, Fan Cooled Motors—These motors have two ventilation systems, an internal fan that drives air over the shell within the enclosure and an external fan that drives air over the shell of the motor and removes the heat conducted through the shell from the inner parts of the motor. The exchange of air between the inside and outside of the motor is insignificant.

Sealed, Hermetically Sealed, Completely Sealed, Moisture Sealed, Encapsulated—These frequently used words do not have a concise definition, but so far as our subject of motors is concerned, they should all mean that a motor having a moisture-sealed winding, for instance, can continuously maintain the dielectric and mechanical strength of the winding against the weakening effects of absorption, penetration or mechanical actions of the ambient air with its most severe content of water, chemical vapors, conductive dusts, etc., hot or cold, or through the varying heat cycles usually found in petroleum plant applications. A moisture-sealed winding does not protect against the accumulation of dust which can cause overheating (see the later discussion under "Clogging").

Weather Protected, Type II, Motor Construction—An ambient breathing motor having an intricate ventilation system of blow-through passages, low vertical velocity, and at least three abrupt changes in direction to minimize the entrance to the motor windings of large solid particles of dust and water.

Weather Protected, Type I, Motor Construction—The NEMA definition is so general that it can be met by a dripproof motor with screens (which in turn NEMA calls Dripproof Guarded). Here is the exact NEMA wording on Weather Protected, Type I.

"A weather-protected machine type I is an open machine with its ventilating passages so constructed as to minimize the entrance of rain, snow and airborne particles to the electrical parts and having its ventilating openings so constructed as to prevent passage of a cylindrical rod ¾ in. in diameter."

Many people now take Weather Protected Type I to mean the motor also has a moisture-sealed insulation system and outdoor mechanical modifications. To be somewhat more descriptive, we will here call this type of motor "Weather Protected, Type I, Moisture Sealed."

Fan Cooled vs Weather Protected

In applying totally enclosed, fan cooled motors, concern need only be given to the effect of the temperature and contamination of the outside ambient upon the outer parts of the motor; i.e., the external fan and fan cover, the end shields, the stator frame, shaft and shaft seals, and conduit box. There are a number of different types of totally enclosed, fan cooled constructions, however, and a user should analyze the ability of each type to withstand his particular conditions. Space heaters are sometimes desirable if a totally enclosed, fan cooled motor will stand idle for long periods of time in a humid atmosphere.

The new Weather Protected, Type I, Moisture Sealed motors, however, are ambient breathing and all contaminants which are in the ambient are carried through

the inner parts of the motor, with little attempt made even to clean up the ventilating air as is done in a Weather Protected Type II design, or excluded entirely, as in totally enclosed, fan cooled. Thus, it is obvious that the degree of consideration of ambient conditions becomes increasingly important as one progresses from motor enclosures of totally enclosed, fan cooled to Weather Protected Type II and Type I.

Design Features

Sealed Insulation—The new sealed insulation systems are the heart of Weather Protected, Type I, Moisture Sealed motors and motor manufacturers have gone in many different directions on how to "best" do the job. Two principal types of coils are used in motors, the random-wound and the form-wound. Random coils are used in low-voltage motors only and have many turns of individually insulated round wire, the coils being approximately diamond shaped. Each coil side is fed into its proper insulated stator slot, pressed down to conform with the shape of the stator slot, and wedged in place. The end turns are separated by insulation at phase points and are laced together, and sometimes tied into a bracing ring, and connections brought out. At this stage, the winding has little mechanical strength and the strength comes from repeated dips and bakes in insulating varnishes which bind together the individual coil turns and sets up the bracing and ties. Modern random windings have extremely fine characteristics and in certain ratings are often even more rugged than the form coils they have replaced.

To moisture seal a random system, its end turns are covered with an impervious material, sealed to the end laminations and the slot portion also completely sealed. Some manufacturers dip the complete stator in an epoxy varnish, occasionally under vacuum, to make this covering and seal; others mechanically spread on a silicone rubber overcoat; sometimes the earlier varnish treatments are eliminated and the whole stator is enclosed in a mold with epoxy fed in under vacuum, resulting in a very smooth heavy section coating on the end turns. Then, there are combination treatments that start off with the epoxy varnish, add alkyd varnish for strength, then an overcoat of silicone rubber. Thickness of the seal should not be considered an indication of the degree of sealing.

There are many random wound, moisture sealed insulation systems on the market today, and all have their weaknesses and their strengths. Horsepower and speed of a motor are factors in determining the most effective system. A good system for a 3-hp motor may have definite disadvantages for motors of 60 hp or 150 hp or vice versa.

Some problems have occurred in sealed random windings with cracking or incomplete initial seals and with overheating. This latter point is worth a brief explanation.

NEMA rates motors with a certain temperature rise, which is the hottest place on the outside of the winding that can be read by a thermocouple or a thermometer. Certain factors have been developed over the years to approximate the hottest place within the winding (i.e., where turn-to-turn insulation is being stressed the hardest), but the new sealing techniques obviously impede heat transfer and make uncertain the established "hot spot" factors. For the time being, average temperature rise by resistance is the best measure of the performance of the motor.

Form coils are always used for motors over 600 v and on large low-voltage motors. These are built up of fewer turns of individually insulated rectangular wire, wrapped with the complete insulation system, accurately sized and shaped, baked, varnished, etc.

In the case of formed coils, moisture-sealed systems consist of having a sealed coil before ever installing in the motor. One system uses a fabric reinforced silicone rubber type which, after vulcanization, becomes one continuous structure doing the insulating and sealing job with one material. Another method covers a conventional coil with an irradiated polyethylene tape which, when heat treated, shrinks and seals hermetically, and then over the irradiated polyethylene tape is wound an armor tape for mechanical protection. The third system uses a glass tape with mica flakes in a solventless resin. A fourth approach is to use individual layers of unsupported silicone rubber and glass tape.

Some form wound moisture sealed coils are not as rigid in themselves as the unsealed designs they replace, and bracing, tying and wedging techniques are even more critically important than they have ever been before. The forces involved in the coils, especially 3,600- and 1,800-rpm designs, are tremendous and adequate bracing requires a great deal of engineering effort.

The materials used to seal random and form coils are all quite unaffected by most chemical contaminants found in industry, but the motor manufacturer should be asked to comment on the effect upon the seal of the specific contaminant that will be present.

Outdoor Mechanical Modifications—Having sealed insulation systems available makes Weather Protected, Type I, Moisture Sealed motors possible, but mechanical modifications for outdoor service make them practical. Some comments were made under "corrosion" of the treatments required by the inner parts of Weather Protected, Type I, Moisture Sealed motors, but two other critical areas require protection.

The conduit box must be waterproof and tightly sealed against the stator frame and around the motor leads entering the conduit box. If the seal is poor at this point, moisture passing through the motor will collect in the vulnerable conduit box and may cause failure.

The bearings need special protection to keep moisture out of them, both when the motor is idle and when it is running. It is especially important to provide a rugged labrinth-type seal at the output shaft.

Application Check Points

Explosion Hazard—To begin with, a Weather Protected, Type I, Moisture Sealed Motor can only be used in a nonhazardous, or Division 2 semihazardous, location. As mentioned, totally enclosed, fan cooled is available in several constructions, one of which is Division I explosionproof. If a Weather Protected, Type I, or even a totally enclosed, fan-cooled standard is to be used in a Division 2 area, all normal arcing parts, such as slip rings, bearing temperature relays, over-temperature thermostats, and inherent overload protective devices must be hermetically sealed, pressurized with nonhazardous atmosphere, or be in an enclosure capable of withstanding an internal explosion without propagation of flame to the outside.

Although space heaters are not required, so far as the new insulation systems are concerned, some users feel they are worth-while to help minimize corrosion of the inner parts of the motor when shut down. If space heaters are used in a Division 2 area, their surface temperature must not exceed 80% of the ignition

temperature of the hazardous gases that might be present. For most applications in Division 2 areas, this limit is assumed to be 200 C total temperature.

Corrosion—In totally enclosed, fan cooled motors, corrosion problems are limited to the outside of the motor and are quite easily handled with massive sections of corrosion-resistant material. With Weather Protected, Type I, Moisture Sealed motors, corrosive conditions will exist inside and outside the motor and it is not possible to completely solve the problem by choice of materials. For instance, the stator and rotor iron must be chosen for its electrical characteristics and consists of hundreds of individual laminations pressed and held together, often with radial ventilating ducts spaced throughout. The rotor bars of induction motors are normally aluminum, threading through intricately shaped holes in the rotor laminations. The very important air deflectors are bell shaped, drawn sheet steel. Since material choices are limited, the only remaining approach to prevention of internal corrosion is to plate and coat extensively the inner parts of the motor. A user should assure himself that each manufacturer will provide adequate protection against the corrosive conditions that will actually exist.

Several factors tend to make inner corrosion less of a problem than at first thought probable. Corrosion is usually more severe when moisture condenses on a surface. The great mass of cooling air only passes through a motor when it is running and therefore when its surfaces are hot. When the motor is idle, it is usually dripproof to the outside environment.

Most applications have varying environmental conditions—heavy moisture only when it rains, extreme corrosion only when there is an operating upset or mechanical failure. The diet is not steady and the corrosion problem, like insulation life, is one of averages.

Another favorable point about, at least, the larger motors, is the greater accessibility of Weather Protected, Type I, Moisture Sealed as compared with totally enclosed fan cooled. It is quite easy to open Weather Protected, Type I, Moisture Sealed motors for inspection and maintenance without removing the motor from the driven equipment.

Erosion—This abrasive problem involves both the inner metal structure of the motor and the windings, especially at the end turns, over which is driven high velocity air from the rotor-mounted fans. Resilient-type materials withstand erosion very well, but hard coatings, such as the coatings used to prevent corrosion, tend to be polished away. Fortunately, the applications are not common where heavy corrosive and erosive conditions exist together, or are cyclic. Where they are, certainly a totally enclosed, fan cooled motor is best. A Weather Protected, Type II, motor will also perform very well by dropping out particles and perhaps filtering the cooling air before it reaches the high velocity and electrical portions of the motor. Filters should be used and regularly cleaned if the dust particles are fine enough to float.

Clogging—Certain dusts tend to adhere, especially after they have picked up moisture. This can be very serious if ventilation ducts are clogged or the build-up on a surface is enough to impede normal heat transfer. The dust is being pulled through the motor in great quantities only when the motor is running and is hot, and the dust usually will not have a chance to pick up moisture within the critical areas of the motor. For applications where clogging is a possibility, regular maintenance is very important and all such motors should be equipped with inherent overload protectors, or at least overtemperature thermostats, or resistance temperature detectors for long-time overheating alarms and back-up overload trip. (The new inherent overload devices now available will respond quickly enough to protect motors against short time abuses, such as stalls or single phasing, allowing their use without remote overload relays while such is not the case with resistance temperature detectors or conventional thermostats.)

Large Motor Applications

Large motors have their own application problems. A few points involving enclosures and insulation systems deserve comment. To begin, totally enclosed, fan cooled motors, where air is blown over the outside of the motors, are not practical when the motor is more than 4 ft in diameter. Thus large synchronous and induction motors can only be used in Division I areas if the outside air is excluded by maintaining a positive pressure on the inside of the motor and providing, usually, an internal air-to-water heat exchanger. Sometimes an inert gas or instrument air is used and then special low leakage shaft seals are required to hold down gas or air consumption. Other times, a large quantity of air is blown in from a clean remote source and discharged after passing through the motor. This flow of air maintains a positive pressure within the motor and cools it as well. Care must be taken to provide for proper purging in any of the three systems.

In Division 2 areas, Weather Protected, Type I, Moisture Sealed or Weather Protected Type II can be installed, provided, in the case of synchronous motors, the slip rings are enclosed in a pressurized or explosion-proof box and arcing accessories are hermetically sealed. Sometimes the remote ventilation system is used in an attempt to reduce the corrosive fumes driven through the motor, but this seems to be losing favor to ordinary Weather Protected, Type II, or Weather Protected, Type I, Moisture Sealed construction.

Weather Protected, Type I, Moisture Sealed synchronous motors have, besides the sealed form coils described above, a sealing problem on the field coils, which are more often encapsulated in epoxy.

One problem with enclosed synchronous motors is the difficulty of observing slip ring brush wear. Some designs are available with windows but these often cloud over, making observation very difficult. Slip ring brush life is usually not a problem but, where it cannot be observed, brushes should be replaced on the periodic shutdowns, even though they still have considerable wear left.

In order to decide in the large motors which enclosure, insulation system and ventilation arrangement is best for any particular application, it is necessary to develop carefully installed costs including the accessory equipment and balance this against what each approach will do for the user in the areas of maintenance, total installation reliability, space requirements, operating simplicity, etc. The size of the motor and voltage level have an important influence on which equipment design should be used.

To sum up, substantial savings, especially in larger ratings, are now available to motor users, but to insure succesful application, the user must carefully study and evaluate each system available. He should consider the engineering principles involved, the development and quality control tests performed, the field experience and the repair problems and repair facilities available. On the other side, the user should specify as thoroughly as he can the actual field conditions he expects. Motor designers have many choices available; only by a free exchange of information can the best be furnished.

Looking for a better way to find annual kwh of electrically heated homes? Here's an approach which relates heat loss to

VARIABLE "C" CONSTANT

HOWARD S. SMITH, POWER SALES ENGINEER, COMMERCIAL-INDUSTRIAL, COLORADO CENTRAL POWER CO.

For some time the electrical industry has been concerned with the kwh consumption figures resulting from presently existing methods of calculation. The classic formula is:

$$\text{Kwh} = \frac{\text{kw} \times \text{DD} \times \text{"C"}}{\text{TD}}$$

Kwh = kwh for the year
Kw = kw of calculated heat loss
DD = degree days
C = NEMA constant
TD = temperature difference (inside temperature less outside design temperature)

This formula seems to be a good one if the NEMA C constant becomes a **variable** dependent on the rate of heat loss and with the results modified to take into account the orientation of the home, and near perfection in insulation is achieved.

This discussion will show (1) the steps in the development of the accompanying curve, which relates rate of heat loss with the C constant, and (2) an example of how the curve can be used to speed the calculation of what is believed to be a more reasonable value of annual power consumption.

Floyd Olson, Solar Electric Heat & Insulation Inc., Salt Lake City, has insulated many homes to 6 w per sq ft heat loss (using one air change) and has found that the electrical energy for most of these homes could be calculated if a factor C of nine were used in the above formula.

Olson also surmised a relationship between heating costs based on orientation. For his area this proved to be about 10c per sq ft per year for homes where major portions of the windows face east or west, 8c per sq ft where the major portion of the windows face south and 12c per sq ft where the major portion of the windows are to the north.

The value of C of 19 has proved satisfactory for a house with a loss of 24 w per sq ft. The following assumptions are used to calculate the in-between values.

1. One air change per hour is used for heat loss calculations to determine kw in the NEMA formula.
2. That a factor C of nine be used in the NEMA formula for all homes with a watt per sq ft heat loss of 6 and below.
3. That a factor C of 19 be used in the NEMA formula for all homes with a watt per sq ft heat loss of 24.
4. That the free heat received in the home on a yearly basis is 50% of the total heat supplied for a home with 6 w per sq ft loss at design temperature.

Results of the calculations relating intermediate values of C vs watts per sq ft heat loss, Col. No. 1 and No. 6 on the table, provide the coordinates for the curve. Now let's use the curve. (See calculation, p 64)

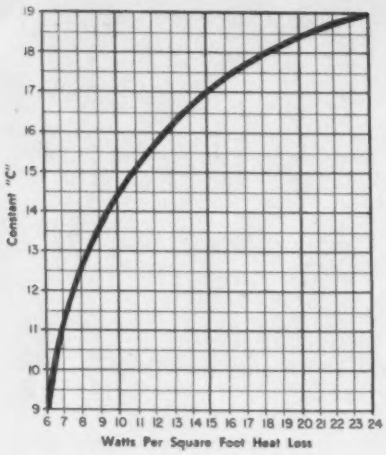
The NEMA factor between 6 w per sq ft. heat loss and 24 w per sq ft heat loss is calculated in the following manner:

$$C = C\ 6\ w/ft^2 + \left\{\frac{\%\ \text{req. heat at x w/ft}^2 - \%\ \text{req. heat 6 w/ft}^2}{\%\ \text{req. heat 24 w/ft}^2 - \%\ \text{req. heat 6 w/ft}^2}\right\}(C\ 24\ w/ft^2 - C\ 6\ w/ft^2)$$

this reduces to:

$$C = 9 + .266 \quad [\%\ \text{required heat (Col. No. 5)} - 50]$$

1. WATTS SQ FT	2. TOTAL UNITS TO BE SUPPLIED PER YEAR	3. FREE HEAT REQUIRED PER YEAR	4. NET TO BE SUPPLIED BY HEATING SYSTEM	5. % TOTAL HEAT TO BE SUPPLIED BY HEATING SYSTEM	6. CALCULATED NEMA CONSTANT
6.0	6.0	3	3.0	50.00	9.00
6.1	6.1	3	3.1	50.82	9.22
6.2	6.2	3	3.2	51.61	9.43
6.3	6.3	3	3.3	52.38	9.63
6.4	6.4	3	3.4	53.125	9.83
6.5	6.5	3	3.5	53.85	10.03
6.6	6.6	3	3.6	54.55	10.21
6.7	6.7	3	3.7	55.22	10.39
6.8	6.8	3	3.8	55.88	10.57
6.9	6.9	3	3.9	56.52	10.74
7.0	7.0	3	4.0	57.14	10.91
7.1	7.1	3	4.1	57.75	11.07
7.2	7.2	3	4.2	58.33	11.22
7.3	7.3	3	4.3	58.90	11.37
7.4	7.4	3	4.4	59.46	11.52
7.5	7.5	3	4.5	60.00	11.75
7.6	7.6	3	4.6	60.53	11.81
7.7	7.7	3	4.7	61.04	11.94
7.8	7.8	3	4.8	61.54	12.07
7.9	7.9	3	4.9	62.03	12.21
8.0	8.0	3	5.0	62.50	12.32
8.1	8.1	3	5.1	63.00	12.47
8.2	8.2	3	5.2	63.40	12.58
8.3	8.3	3	5.3	64.00	12.74
8.4	8.4	3	5.4	64.40	12.84
8.5	8.5	3	5.5	64.71	12.92
8.6	8.6	3	5.6	65.20	13.06
8.7	8.7	3	5.7	65.60	13.17
8.8	8.8	3	5.8	66.00	13.27
8.9	8.9	3	5.9	66.30	13.36
9.0	9.0	3	6.0	66.70	13.45
9.5	9.5	3	6.5	68.42	13.91
10.0	10.0	3	7.0	70.00	14.34
12.0	12.0	3	9.0	75.00	15.70
15.0	15.0	3	12.0	80.00	17.00
20.0	20.0	3	17.0	85.00	18.35
24.0	24.0	3	21.0	87.50	19.00



Using the Curve

The following sample calculation is an aid in using this curve:

1,200-sq-ft home
DD = 6,000
TD = 80°
Heat loss = 10,560 w

Assumed Conditions

$$\frac{10{,}560}{1{,}200} = 8.8 \text{ w per sq ft}$$

From the curve, C = 13.3

$$\text{Kwh} = \frac{10.56 \times 6{,}000 \times 13.3}{80}$$

Kwh = 10,533 kwh

If this same home was insulated so that the watt per sq ft heat loss is 6 w per sq ft, the following kwh consumption would be realized:

Kw loss — $6 \times 1{,}200 = 7.2$ kw
C = 9 for 6 w per sq ft

$$\text{Kwh} = \frac{7.2 \times 6{,}000 \times 9 = 4{,}860 \text{ kwh}}{80}$$

Diff. = 10,533 — 4,860 = 5,673 kwh

Orientation Factors

A further alteration of C is proposed, depending upon the orientation of the home. If the major portion of the windows face south, C as determined from the curve should be multiplied by .9; if the major portion of the windows face east or west, C should be multiplied by 1.0; if the major portion of the windows face north, C should be multiplied by 1.2.

It is proposed that this curve be used to evaluate existing and new homes and that such results for various areas be tabulated to check the accuracy of this curve. In areas where there are fewer days of sunshine and greater wind than experienced in the Colorado-Utah area, higher NEMA constants will result.

Professor Charles Dalziel, U. C. shock expert, devises main line breaker to

HELP PREVENT

If a person can't "let go," can a circuit breaker be designed that will "let go" for him before his heart "lets go" of his very life? That is the question for which Charles Dalziel, University of California professor of electrical engineering, one of the world's leading researchers on electric shock, has been seeking an answer.

While electricity well handled is reasonably safe nowadays, Professor Dalziel's research on electric shock brings up alarming statistics as to the continuing number of electrocutions in homes and in industry. Most of these come from line-to-ground contacts. Among the most frequent causes are the breakdown of insulation in portable tools, such as portable drills and saws. A lawn mower or a hedge clipper which sometimes cuts through the supply cable and is operated often in contact with the damp earth is especially dangerous. A recent California case of electrocution came about when a man dropped his electric razor in the toilet bowl and reached in after it. Numerous fatalities are reported among children who came between a floor lamp with defective cord and a radiator or other grounded metal object. The resistance in a long wire circuit is enough to keep the 15-20-amp fuse or circuit breaker from opening. However, it allows enough current to flow through a person to freeze him to the circuit or cause fibrillation of the heart and instant death.

Meanwhile arguments continue as to whether grounding or insulation is better. There are advocates of using the white wire or neutral as a grounding circuit. There are others who insist that appliances and lamps be double insulated. The trend is being pushed toward three-wire grounding cords for use with all portables and toward having all the metal in a home or building bonded to a common ground.

Moreover, considerable pressure is being exerted nowadays for the doubling of the service voltage to homes. While it offers economics in wiring cost, will these be overbalanced by the extra shock hazard that these higher voltages may introduce?

In a paper for the AIEE in January, 1961, Professor Dalziel summarized the problem and told of his research in Europe among electricity suppliers already using higher voltages for residential service. He was especially interested in the efforts of Europeans to reduce hazards from electrical shock caused by line-to-ground short circuits by the use of special circuit breakers having ultrasensitive line-to-ground elements. He says this development started in Germany in 1919 with a simple voltage sensitive mechanism. Devices called "earth leakage circuit breakers" he found to be in use in quantity in Austria, Germany, Ireland and the United Kingdom. "They are reasonably priced and operate on a potential to ground of about 65 v," he said. "Essentially the sensing unit consists of a trip coil connected between earth and grounding system which is insulated from the ground. These breakers provide protection against line-to-ground faults and associated fire hazards. Some 10 years ago, trip devices actuated by the current flowing to ground were developed. These devices originally had a minium trip current of 1 amp. Recently the trip value has been reduced to 300 ma and still more recently two commercial circuit breakers have been placed on the market in France and Austria having a sensitivity of 30-40 ma. The chief requirement of such installations is that there be no intentional ground on the load side of the circuit breaker."

Dalziel feels that the new circuit breakers deserve serious consideration in America, especially in connection with the proposal to double residential voltage. When such a circuit breaker incorporates a differential or balanced current transformer with a trip mechanism actuated by ground currents of the magnitude likely to exist during an accidential human contact between an energized conductor and ground, the name "differential circuit breaker" is given it. The French design has this differential trip mechanism as an additional feature to the conventional overcurrent and short circuit trip elements and is built into the same

ELECTROCUTIONS

molded case. In Austria, however, the differential trip is the only automatic feature provided in the circuit breaker currently being manufactured there.

While it is gratifying that these circuit breakers in Europe have operating characteristics to provide protection against ventricular fibrillation for currents up to the maximum likely to flow between major extremities during human accidents, it appears to Dalziel that the minimum trip current must be set in excess of let-go currents to avoid excessive circuit outages. Such trips might be due to insulation leakage and capacity in the line. The minimum current setting of the differential trip device is established by the maximum leakage current likely to develop. This is set not for the typical modern installation but in many old installations during a humid or wet condition where full appliance load is on. This would have to include rod-type heating elements, which have rather high leakage currents. Too low a trip value would cause unwarranted nuisance tripping.

There is no way of telling, however, what the minimum current would be in accidental contact between an energized part and ground. The resistance of the skin is affected by moisture and the thickness of the epidermis. The resistance of nonmetallic floors, earth, concrete, etc., is also indefinite. It depends on the moisture present.

However, the European manufacturers are using 30-40 ma for the minimum trip value of their differential circuit breakers. The public utility, Electricite de France, is conducting a survey of installation resistances to attempt to place the subject on a scientific basis.

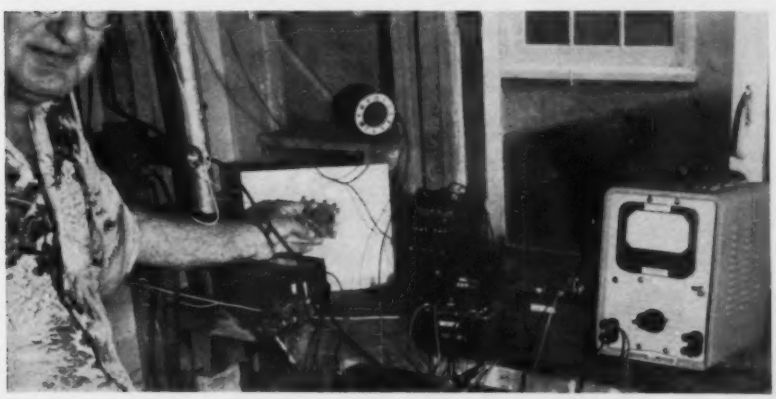
From Professor Dalziel's own research at the University of California it was found that currents of 9-16 ma constitute a let-go hazard. To limit circuit breaker trip currents to such low values he feels is a significant technical accomplishment and a big improvement in electrical safety. "Actually there is little evidence of serious injury from currents below about 30-50 ma," he declares from his own research. "However, this is a great improvement when you think that the present house circuit is protected with 15- or 20-amp devices that are totally inoperative on the currents likely to flow through the human body during an accident."

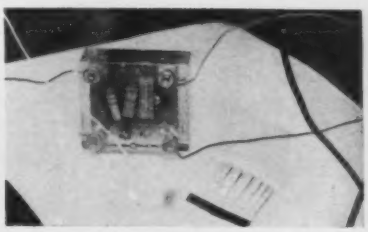
Realizing that any device developed to be acceptable in American practice would have to withstand short circuit currents up to 5,000 amp, Professor Dalziel proceeded to develop trip circuits suitable for application on typical single-phase, three wire, 120-240-v, 100-amp circuits having an interrupting duty of 5,000 amp.

Employing the three 100-amp wires of the service conductors as the primary winding of the differential transformer, a second winding of about 1,000 turns is applied to the core surrounding these service conductors. He has found that the line-to-ground trip current can be separated very accurately from the load currents by this means. Magnetic cores shunted with zener diodes or thyrite are devised to protect the transistorized trip circuit for the one to two cycles required for the instantaneous magnetic trip that operates on high short circuit current.

Dalziel has been able to develop the pilot model, illustrated here (cast in clear plastic to show the components) that could be incorporated in the making of a circuit breaker of not too large a size. Present costs of the components are such, however, that it is not expected it would replace existing circuit breakers. He feels, however, that the differential circuit breaker could well find application as a service switch for the safer home or as the main circuit breaker on a distribution or lighting panel or to protect circuits where the highest possible degree of protection against line-to-ground short circuits are paramount. Such areas where the hazards of electric shock, fire or explosion must be reduced to as great a degree as possible would find this differential circuit breaker a means to get higher levels of safety than heretofore possible. Such places as swimming pools, playgrounds, work areas having dirt or concrete floors, dark rooms, laboratories, hospitals, sanitariums, ships, docks and pleasure wharves, construction jobs, oil refineries, gas compressor rooms, munitions and explosives factories, mines, chemical laboratories, trailer camps and the home are potential applications.

In developing this device and testing it in his own home, Professor Dalziel found that it was necessary to track down all of the leakages to ground. Some of these paths were quite devious, involving not only the water and gas piping but air ducts and flues and metals in contact with them.





Encapsulated in plastic, even the pilot model, above, using a tiny transistor, is small. Experimental equipment in his own basement used by Dalziel in developing a device that can later be built in a small circuit breaker protecting a circuit or main

REVIEW OF EHV TRANSMISSION

From Ryan to Leadville and now BPA the West has been in the vanguard in operating systems and in fundamental investigations

DONALD H. SANDELL, ROME CABLE DIVISION, ALUMINUM CO. OF AMERICA

The task of electric power transmission lines—to transmit electric power from one point to another with a minimum of power loss and voltage drop—has never changed. However, the tremendous increase in electric energy consumption since transmission lines were first built has changed their appearance and greatly amplified their function.

Today's extra high voltage (EHV) lines perform in one or more of four different roles:

1. Backbone of transmission grid;
2. Long distance supply line from hydro installations;
3. Bulk carrier of thermal generated power (energy transportation vehicle);
4. High capacity bus between large power plants.

Backbone of Transmission Grid—As early as 1920 high voltage transmission lines were employed for this purpose in both the Midwest and the far West. Of course, these high voltage transmission lines were not the EHV lines of today—they were in the 66-100 kv range, contrasted with current general definition of EHV as being voltages above 220 kv.

Long Distance Supply Lines From Hydro Installations—The need for EHV lines to supply electric power to load centers from large hydroelectric installations arose early in the century, when engineering solutions to economical production of electric energy from falling water were found. Two of the early high voltage transmission lines representing this function are still operating in California. One, the 110-kv San Bernardino-Bishop line, now part of the California Electric Power Co., was built in 1912. This line used 4/0 ACSR to permit the economical long span construction needed for this long line. ACSR was a relatively new product in 1912, having been developed three years previously.

The other line, built in 1913, was the Big Creek line of the Southern California Edison Co. This line used 605,000 cm ACSR 54/7. It was later to become the highest voltage transmission line in the world, when in 1923 the voltage was stepped up from 154 kv to 220 kv. It remained the highest voltage line until 1936, when the Hoover Dam transmission lines were energized at 287 kv.

Bulk Carriers of Thermal Generated Power—After World War II, our nation was faced with a great deficit in electric generating capacity. At the same time, the available hydro installation sites for economical private utility development were diminishing. Steam-electric plants were, therefore, built at a faster rate. At first they were built as close as possible to load centers so that transmission line costs including power losses could be kept at a minimum. However, some economic analyses revealed that transmission costs were competitive with the cost of transporting coal or other forms of thermal energy to load centers.

Some electric utilities experimented with the "mouth-of-mine" type steam generating stations and found that, indeed, the energy thus produced and transmitted was not only competitive with energy transmitted by other forms of transportation, but was considerably more reliable. Of course, this form of transmitting large blocks of power created new problems, while accenting the importance of some existing ones. Since electric energy must be consumed immediately, interruption of a large block of power supplying a base load to a utility system results in grave consequences. Through the use of high speed circuit breakers and more extensive relaying schemes, stability of these systems has been made very reliable. Thus, an EHV line can be in the transportation business.

High Capacity Bus Between Large Power Plants—Transmission lines are sometimes used merely to provide a high capacity tie between the buses of large electric power plants. Higher generation voltages, combined with the high cost and limited availability of right-of-way in certain areas, have led to the use of extra high voltage lines for such ties.

Tubular compression joint on 2.13 in. rope lay expanded aluminum conductor

Evolution of EHV conductors

Each new step of higher voltages brought with it new questions to be answered before operating lines could be put into service with any degree of confidence. The effect of conductor diameter on corona, for

example, was an important consideration at the high voltages of 50 years ago, as it is at today's much higher "high" voltages. Usually the power load was sufficiently low so that minimum conductor diameter was determined by the corona discharge consideration.

Expanding the conductor with core materials other than the conductor strands was the approach taken to economically attain the required diameter without providing unnecessary load capacity. Transmission lines using hemp rope as a center for copper and aluminum conductors were in operation as early as 1900.

The development of ACSR gave the high strength which permitted the economical long span construction and, by virtue of its steel core, expanded its diameter. This expanded diameter reduced corona at high voltages. ACSR provided a strength, conductivity and diameter combination to satisfy most power requirements up to 230 kv. The 220-kv Big Creek line of the Southern California Edison Co. is a good example of how early this became evident.

Recent studies have found single conductor regular ACSR feasible for some applications at 345 kv. Both 1,780,000 cm ACSR 84/19 and 2,156,000 cm ACSR 84/19 are being used on operating lines at this voltage.

As voltages began to increase to higher values, it became apparent that the answers to high voltage operation could not be found in textbooks or small indoor laboratories. Needed was full-scale outdoor testing to supplement indoor laboratory experiments.

An early project to study the characteristics of lines designed to operate at voltages above 220 was undertaken at the Ryan Laboratory of Stanford University. Early in 1927, the Pacific Coast Electrical Assn. (then the Pacific Coast Division of National Electric Light Assn.) requested several cable manufacturers to donate to the Ryan High Voltage Laboratory nine 700-ft lengths of hollow cable—three samples each of conductors with diameters of one inch, two inches and four inches. Voltages up to 600 kv were to be impressed on the conductors.

Aluminum conductors that employed aluminum wire stranded around flexible aluminum conduit were supplied for testing. The one-inch and two-inch diameter conductors arrived in California in 1929, and the four-inch diameter conductor early in 1930. (The four-inch aluminum flexible conduit core conductor was the only conductor of this size tested by the laboratory.)

In 1932, a new 1.4-in. diameter expanded ACSR was shipped to the Ryan Laboratory for tests. Expanding medium of this initial expanded ACSR was jute filler strands, stranded between the steel core and the layers of aluminum strands. Subsequent experience and tests have determined impregnated twisted paper strands to be best for expanding conductor diameter. After 20 years of testing and development, expanded ACSR was later chosen as the conductor for the huge American Electric Power 345-kv system as well as the OVEC and IKEC 345-kv lines.

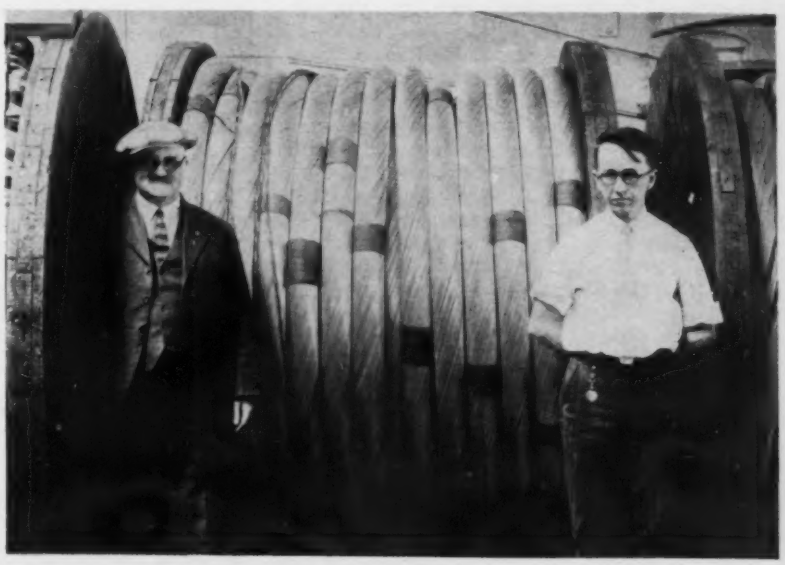
With the exception of the 287-kv Hoover Dam-Los Angeles line, 220 kv and 230 kv were the basic high voltage level of transmission networks until after World War II. When construction of generating and transmission facilities was resumed in 1946 after the wartime hiatus, it was evident that voltages higher than 230 kv would be needed to transmit the larger blocks of power that would be supplied from the new generating equipment being designed. The industry made a limited investigation of the use of 287 kv, because of its successful operation on the Hoover Dam-Los Angeles line, but it was soon abandoned in favor of 345 kv. At either voltage there was more to learn about conductor corona and radio influence characteristics and insulating materials, and to solve these problems for the higher voltage proved a wiser objective.

Before the first operating lines were energized at 345 kv (in 1954), many problems had been intensively studied. Two significant test projects had been established in Ohio. One was at the Tidd Test Site, a full scale outdoor installation by the American Electric Power Co., near Brilliant, Ohio; the other was a coordinating series of tests conducted at the well established Ohio Brass High Voltage Laboratory at Barberton, Ohio.

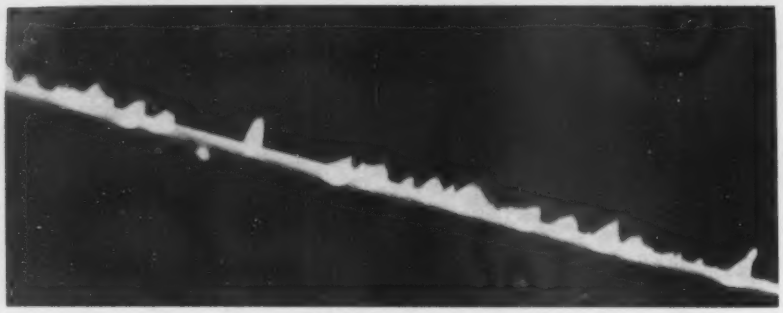
The Tidd test site was a three-phase 500-kv project. Stranded and hollow copper conductor were tested as well as 1.4-in., 1.65-in. and 2.00-in. diameter expanded ACSR.

The test at Tidd resulted in 1.6-in. and 1.75-in. expanded ACSR being used for over 3,000 circuit miles of the American Electric Power Co., Ohio Valley Electric Corp., Indiana & Kentucky Electric Corp. and the Commonwealth Edison Co. systems. Many new construction techniques were developed to handle EHV conductors during the building of these projects. Special stringing blocks, conductor tensioning equipment and giant reels were but a few of these developments. The 96-in. diameter, 16,000-lb capacity reel, for instance, was first proved practical in field erection of transmission conductors on these lines.

Joints, dead-ends, terminal connectors, armor rods and dampers were tested for 345-kv operation at



Reel of 4½-in. aluminum cable furnished to Stanford University for test in 1930



Corona on conductors at 400 kv to ground

the Ohio Brass facility. EHV conductor accessories were designed to have a corona starting voltage at least as high as that of the conductor.

The initial major EHV construction program on the West Coast was by Bonneville Power Administration. In 1956, BPA energized lines at 345 kv using 1,780,000 cm ACSR 84/19. A year earlier, BPA energized over 200 units of 287 kv using 1,272,000 cm ACSR.

By the mid-'50s, the characteristics of large conductors designed for 345 kv were fairly well established—except for high altitude operation. The Public Service Co. of Colorado was planning a high voltage expansion program that would send transmission lines over mountain passes at 11,000-ft altitudes. No field corona or RI data were available for this altitude, and the laboratory-derived empirical formulas for correlating sea level data to high altitudes were suspected of being too conservative. From observing the operation of 115-kv lines built in the 1920s, there were indications that the corona levels might be lower than the formulas given by either Peek or Peterson.*

To find the answer, a 500-kv three-phase equivalent test line was constructed near Leadville, Colo. Conductors similar to those used at Tidd were supplied by Alcoa. However, two- and four-conductor bundles were added to gain knowledge of the behavior of these arrangements and of the spacers and suspension assemblies associated with them. The elevation at Leadville of 10,300 ft was high enough to provide a good proving ground for high altitude high voltage transmission lines.

Information gained from evaluation of the bundled conductors at Leadville became available as both the American Electric Power Co. and the Ohio Edison Co. were anticipating construction of such lines for 345 kv, constituting the introduction of bundled conductors, for high voltage purposes, to the United States. Bundled conductors at high voltages were a common sight in Europe, but they had not been considered practical for the loads and construction methods in this country. The Ohio Edison Co., however, concluded from its tests that a newly designed 954,000 cm ACSR 48/7 used in a bundle of two was the most practical design for them. By 1960, this utility had built over 300 circuit miles of line using these conductors, suspended from rectangular base towers.

With more information on bundled conductors available, the New York State Power Authority selected a two-conductor bundle of 795,000 cm ACSR 26/7 for the 345-kv Niagara Falls-Adirondack line. Construction on these lines began in 1960, and the same year two more EHV test projects were under way by other companies that would push the voltage in one of these projects to over twice any present operating voltage.

The Pennsylvania Electric Co. project near Martinsburg, Pa., was energized in the fall of 1960 at 460 kv using 1.4-in., 1.65-in. and 1.75-in. diameter bundled expanded ACSR, and 2.32-in. diameter expanded ACSR. The 2.32-in. expanded ACSR was the largest ever used of the paper expanded design. Again laboratory tests on the conductor and fittings had to precede the shipment of these items used on the test project. The G-E test lines near Pittsfield, Mass., energized at 460 kv, have been operated briefly at 720 kv. Some spans will eventually be operated at 750 kv to give answers on corona and RI for transmission lines of the future.

A three-conductor bundle of 954-mcm ACSR 54/7 spaced at 16 in. was tested at 350 kv to ground with one compression joint at midspan. It was found that visible corona appeared on the conductor at approximately 325 kv and at one spot on the splice at 355 kv. The entire splice showed corona at approximately 360 kv.

The G-E and Penelec installations are unique among the EHV studies in that they are prototype transmission systems, contrasted with open-end transmission on the other projects.

Some of the results from the Leadville EHV project confirmed other test programs suggesting that wood pole H-frame structures might be practical for 345-kv transmission lines. In 1960, the Illinois Power Co. built a one-mile wood pole H-frame line (using 1.75-in. paper expanded ACSR) for 345-kv operation, to evaluate feasibility of this type of tower for EHV.

Several new "milestones" in EHV are to be reached in 1961. In one of these, Bonneville Power Administration will be building a 460-500-kv experimental line to test conductor handling and construction techniques. Several conductors of 2.125-in. diameter and larger are to be tested. One conductor will be a 2.14-in. diameter conductor of 5005-H19 aluminum alloy wires stranded around a flexible aluminum alloy conduit. Another conductor will be a new rope-lay concentric stranded combination conductor of 2.13-in. diameter. These designs presented some new problems for jointing or dead-ending, solved with the tubular fittings shown.

During 1961 TVA will undertake an investigation of the problems of 460-kv construction, using three-conductor bundles of 954,000 cm ACSR 54/7. A three-conductor bundle possesses some special mechanical problems with regard to the operation of conductor spacers. One spacer that shows excellent possibilities is a three-conductor closed spring type spacer.

The West has been at the vanguard of EHV, both in fundamental investigations—from Ryan to Leadville and now BPA—and in operating systems—from California Electric Power and Southern California Edison to Colorado Public Service, BPA and Arizona Public Service. The rate of development in this field is greater than ever, and most certainly today's projects will influence the planning and operation of nearly all of our electric systems in the future.

*1. "Dielectric Phenomena in High-Voltage Engineering," F. W. Peek, McGraw-Hill Co.
2. Discussion of "Design of Transmission Lines," J. S. Carroll, B. Cozzens, AIEE Transactions, Vol. 52, 1933.

C. K. Rieger, G-E, and W. L. Cisler, Detroit Edison, speakers at first morning session

P. E. Brookover, RMEL president, with Warren A. Terry, Home Light & Power Co., who succeeds him as president on Jan. 1

Planning RMEL's 58th Annual Convention at Jackson Lake Lodge are B. P. Montagriff, secretary-manager; Donald Spangenberg, PS of Colo., program chairman; Fred Nylander, general chairman, and P. E. Brookover, RMEL president, both of Cheyenne LF&P

RMEL FACES UP TO THE ISSUES

Some challenging statements were made by speakers at the Rocky Mountain Electrical League's Annual Convention, Sept. 10-13, and were accepted thoughtfully by the industry people attending. The setting in the Tetons and the carefully planned program gave time for reflection and recreation as well as conference sessions. It was a stimulating meeting and, as one speaker described it, a friendly one. Here are a few highlights.

Imbalance is a key factor in foreign countries, said Walker L. Cisler, president and board chairman of Detroit Edison Co., in relating observations on his recent overseas mission to discuss power problems and developments. There is imbalance in the distribution of population; skills, knowledge and capability; natural resources; fuels, he pointed out. More thought should be given to the impact of energy on world affairs and to bringing about better distribution and utilization, he believes.

Sales people are the lost generation in the utility business, Charles K. Rieger, vice president and marketing manager for General Electric Co., told the conference. Worried about generation, transmission, federal plans, all essential, utilities have not paid much attention to their sales departments, he charged. Consequently power salesmen are not beating the bushes to work up demand; are selling capacity instead of services and attractive new approaches.

Pointing to the possibility of divorcing customer service and routine relations from sales, he said that manufacturers are not getting needled enough to make the things that will sell, emphasis is being put on cost of operation instead of service reliability. A few of his suggestions: get better trained salesmen; spend a higher proportion of the dollar on promotion tools such as co-op advertising, wiring allowances, prizes, bonuses; develop stronger ties with distributors; persuade dealers to sell electric. "Let's restore growth in this industry and stop talking about it. You are the group who can do it," he concluded.

Opinion surveys show that a large majority of people are unable to recognize that government power affects them, said Don Hoover, president of Bozell & Jacobs. Another area of continuing concern is the widespread public ignorance of the facts, he continued. The answer, he believes, is obvious. The investor owned utility industry must concentrate harder on the key subjects, be clear about its story, find the "you" element that will bring that story home to people, repeat it again and again.

What are we doing about the fact that the average customer looks more favorably on his local company than he does on the national industry of which it is a part, he asked? Is everyone telling an all-industry story at every opportunity or blissfully riding along on local popularity?

Demands being made on management and its public relations advisers are great but they must be met, he stated. Goals must be positive, must be defined in terms of service in its broadest sense and must look ahead, he concluded. It is the responsibility of the intellectuals in and out of government to criticize and the industry's responsibility to act, he concluded.

The deplorable profit situation in

Four convention speakers: Milton F. Kent, general manager, utility sales operation, General Electric Co., Schenectady; Rodger G. Wheaton, president, Line Material Industries, Milwaukee; Arthur R. Barnett, National Association Electric Companies, Washington, D. C.; John C. Clay, vice president, First National Bank, Kemmerer, Wyo.

the equipment industry and the disastrous results of a continued downward earnings trend were forcefully brought out by R. G. Wheaton, president of Line Material Industries. He prefaced his remarks by assurance that everyone associated with the electrical industry is acutely conscious of his responsibilities with respect to the free enterprise system and is today "as white as the driven snow." We need to get back to work full time and can ill afford the time, effort and expense necessary to protect ourselves from persecution and harassment, he stated.

In a competitive risk industry it seems reasonable that a minimum profit margin of 5 to 6% might be expected, he pointed out, but at no time in the past 10 years has the average electrical manufacturer's profit on sales reached this modest level. The peak period, 1951-1955, showed 4.8% and the first six months of 1961, 2.8%. In terms of rate of return on investment after taxes a modest rate is often set at 10 to 12%. Fifteen electrical manufacturers recorded 11.3% for the period 1951-55; 5.6% for the first half of 1961.

Everybody loses in the long run if profits disappear from large segments of an industry, he pointed out. To date product redesign programs have had careful attention with determination to continue high quality at lowest practical costs. His company has devoted endless hours to development of a modern pricing philosophy, he stated.

Forecasts on construction expenditures through 1965, which well may be conservative, will materialize only as a result of a well equipped industry, he pointed out. "These figures predict a load which will tax all elements in our business, particularly the management groups in the utilities, contractors, manufacturers and suppliers. We must constantly remind ourselves 'There's a way to do it better—find it.' Through understanding of our interrelated problems and through cooperation and confidence, we will find the better way," he concluded.

Arthur Barnett, managing director of the National Association Electric Companies, called for a discussion in depth and breadth on national power issues. Pros and cons of such subjects as the proper role of government in generation and transmission should be discussed by the public, which has a great stake in the outcome, he believes.

Participation of industry people in local community affairs and in politics was advised by Charles M. Crowell, Casper attorney. Because utilities are a regulated monopoly and it is a short hop from control to ownership, their people can no longer afford to stay aloof, he believes.

Participation in politics was suggested also by John C. Clay, vice president of the First National Bank of Kemmerer. He suggested a coordinated effort under the two-party system whereby responsible, conservative people in business and agriculture might measure candidates.

L. R. Patterson of Public Service Co. of Colorado brought the conference up to date on the Colorado River Storage project, a subject made more striking by a report given the following day of the defeat in the House of an amendment to delete funds for federal transmission lines for the project.

The current status of atomic power was told by Milton F. Kent, general manager, utility sales operation, General Electric Co.

Warren A. Terry of Home Light & Power Co., Greeley, Colo., was elected president of the league to succeed P. E. Brookover, Cheyenne Light, Fuel & Power Co.

L. R. Patterson, PS of Colorado, Denver, Charles Crowell, Casper, Wyo., attorney, Don Hoover, president of Bozell & Jacobs, New York, Monday afternoon speakers

PEOPLE

► Appointment of **Albert B. Cook** as commercial manager has been announced by Pacific Gas and Electric Co. He succeeds **R. W. Joyce,** who recently was made vice president in charge of commercial operations. A native San Franciscan, Cook joined the company in 1925 upon graduation from high school and later earned his degree at San Francisco Law School by attending night classes. He had been assistant to Joyce during his tenure as commercial manager.

Cook

► Apologies to **Oliver Lyman** and **C. W. Sward** for a caption mixup in our August issue. The gentleman pictured on p 26 with C. W. Leihy is Ollie Lyman, Oliver B. Lyman Co., San Francisco, not Cy Sward, executive director of EERA. Our thanks to the friends who spotted the error and wrote in to tell us that it wasn't even a close resemblance.

► **Evelyn Hansen,** director of home service for Utah Power & Light Co., is serving her tenth year as director of Home Arts for the state fair. Appointed by the governor, she has two years to go on her present three-year term.

► **E. W. Bullard** of Sausalito, Calif., has been elected president of the Industrial Safety Equipment Assn. Bullard is president of the 44-year-old E. D. Bullard Co., manufacturer of industrial safety equipment. He is a life member of the San Francisco Chapter, American Society of Safety Engineers, and of the California Governor's Safety Council and the President's Council of Occupational Health. He was first chairman of the Northern California Chapter, Veterans of Safety.

Bullard

► **Carl L. Twidwell,** district power superintendent for Pacific Power & Light Co.'s Lewis River plant, retired after 45 years of service. He joined Northwestern Electric in 1916 at the Condit plant. During the time he headed Lewis River operations, Yale project was completed and Swift project, world's largest earth-fill dam, was built. Twidwell plans to be a tree farmer, operating a 1,200-acre farm at Trout Lake.

► **E. Robert de Luccia,** vice president and chief engineer of Pacific Power & Light Co., was named consultant to the government of Japan for the Sept. 18-23 symposium on dams and reservoirs held in Tokyo under the auspices of the U. N. Economic Commission for Asia and the Far East. He is a member of the International Commission on Large Dams of the World and discussed design and construction of Yale and Swift Dams.

► **George A. Lloyd** has retired in Los Angeles following 28 years as a sales manager for General Electric's major appliances in northern and southern California. W. B. Frogue, general manager of the company's appliance dealership in southern California, presented him with a plaque and diamond-studded watch at a banquet attended by company executives and sales personnel.

► **Walt Madsen** and **Orville McManman,** hydro maintenancemen at Portland General Electric's Pelton project, rescued a five-year-old California boy lost in the rugged, rattlesnake-infested Crooked River canyon. Ending a 30-hour search, the two men spotted the boy 15 miles from his family camp, hungry but unharmed. Madsen figured in another Good Samaritan role recently with Bruce Thrasher of PGE by giving first aid to an 18-year-old boy injured by a speedboat propeller. Doctors said that the action of the two men undoubtedly saved the boy from bleeding to death.

Lawrence G. Maechtlen, left, president of Square D, recently received a 35-year service pin. Making the presentation at Park Ridge, Ill., is the man who hired him, Joseph H. Pengilly of Los Angeles, a company vice president and director.

► **Mark D. Stenson,** former project engineer for the Washington Public Power Supply System, has joined the firm of R. W. Beck & Associates, engineering consultants. With headquarters in the Seattle office, he will work with clients in the Northwest, Alaska, the Midwest and Southwest.

ATTENDING the Pacific Power & Light Co. board meeting at Astoria, Chairman Paul B. McKee and A. S. Cummins, former Copco president and now vice chairman of the PP&L board, try out a local product, Lektro Car. The electric golf cart is made by Willamette Aircraft Co.

Apple Grove, W.Va.
June 22, 1961—
Westinghouse
and American Electric
Power threw the switch on
a prototype 750kv line

APPLE GROVE advances the art of Extra High Voltage transmission.

The 750-kv transmission test project at Apple Grove will save electric utilities millions of dollars in the future. Research conducted here will evaluate new techniques and equipment developed by Westinghouse for EHV transmission of huge blocks of power.

Research objectives are:

SIMULTANEOUS comparison of radio influence and corona loss performance of 2 conductor diameters in 3 different configurations under identical atmospheric conditions.

EVALUATION of mechanical features of sub-station, towers, conductors and hardware.

EVALUATION of electrical features of transformer, arresters, coupling capacitors and conductors.

EHV lowers the cost of transmitting bulk power:

REDUCES power line losses.

REDUCES capital cost of transmission facilities.

REDUCES need for new rights of way.

EHV interconnections permit more efficient power pooling:

REDUCES amount of generating capacity now tied up as reserve for peak loads and reliable service.

REDUCES capital cost of new generating capacity through the application of larger units.

REDUCES generating cost through improved efficiency of larger units.

REDUCES generating cost by locating plants close to lower cost fuel.

IMPROVES economic tie-line dispatch.

Apple Grove, W.Va.
Westinghouse transformers are ready now to power tomorrow's EHV lines

Westinghouse has pioneered the technical developments which have lead to the high voltage transmission systems of today. In particular, EHV transmission of the future presents no problems for Westinghouse transformers. The exclusive "Form-Fit"® corona-free design with forced oil cooling, close-fitting tank and vertical coil construction result in EHV transformers that are both smaller and lighter per kva making possible the manufacture of capacities necessary for the ever larger stations of tomorrow. Westinghouse transformers are ready now to serve any foreseeable voltage level—meeting the challenge of the super-voltage future.

125,000 kva, 3-phase, auto-transformer steps up 138 kv-supply voltage to 750,000 volts at the joint Westinghouse-American Electric Power test facility at Apple Grove, W. Va. During initial test, lines were energized at 775,000 volts, establishing an EHV record.

Since 1886—Westinghouse "Contributions" help electric utilities keep pace with America's growing power needs.

1886 George Westinghouse introduced first A.C. transformer into the United States.

1890 first 3000 volt A.C. system installed at Portland, Oregon.

1897 first 40,000 volt transformer.

1907 first condenser bushing — an Industry standard today.

1921 first 220,000 volt transformer.

1932 introduced vacuum filling and corona-free design. Pioneered impulse testing—confirmed high voltage designs. Introduced Hipersil, grain oriented core materials. Introduced forced-oil cooling to increase transformer loading 66⅔%.

1935 built the 287,000 volt Hoover Dam transformers—highest transmission voltage at that time. Reduced dielectric test level.

1943 introduced "Form-Fit"®, shell form tank, reducing transformer weight and size.

1946 first 500,000 volt experimental transformers used at Tidd EHV Project.

1952 first 345,000 volt commercial installation of power transformers.

1956 built world's largest sound test room.

1957 designed and built the first Schnabel railroad car to facilitate transformer shipment. First high altitude EHV tests at Leadville, Colorado.

1958 introduced inner-cooled construction to reduce transformer weight and size up to 25%. Introduced INSULDUR® insulation to permit 10% greater thermal overload capability.

1960 introduced an improved INSULDUR® insulation to permit 12% greater continuous thermal capability at 65°C.

1961 completed design and began construction of 600 MVA transformer—world's largest. Westinghouse and American Electric Power conducted first EHV tests at Apple Grove at a 775,000 volt level.

B

C

Apple Grove

project is a typical example of
Westinghouse research and development
in meeting America's future power needs.
Such major programs stem
from the support of electric utilities through
their purchase of Westinghouse equipment.
As a result, when you purchase
Westinghouse products you also are helping
provide the knowledge and experience
necessary to build power systems
scaled to the need of the future.
You can be sure . . . if it's Westinghouse.

A

D

E

F

A. Greenhouses contain meters to check radio influence on each line at distances of 100 to 200 feet from center phase. Three meters in each group are all of different design and based on three different theories of radio influence generation.

B. De-couplers block radio-influence (RI) on any one line from interacting with that produced on other two lines, allowing simultaneous independent readings.

C. From central substation, three 2400-foot, 3-phase test lines extend to form a "T". Each line uses different sized, bundled conductors on 18-inch centers. A heating current is carried in each conductor to prevent condensation and simulate actual operation.

D. Three 528-kv station-type lightning arresters protect the 750-kv windings of the auto-transformer from line surges and lightning strokes.

E. Control panel and electronic recorder that logs data from 60 test points at 20-minute intervals. Abnormal readings will automatically reduce interval to every 2 minutes.

F. 125,000 kva, 3-phase auto-transformer steps 138,000-volt supply to 750,000-volt test voltage. Condenser bushings, 24′ in overall height, are rated at 1800-kv BIL.

CP-1068

Westinghouse

Home of Mr. and Mrs. B. G. Bergeron, Montebello, California

WHEN THE FUTURE IS ALL-ELECTRIC

WHY BUY ANYTHING BUT A ***TOTAL-ELECTRIC GOLD MEDALLION HOME?***

"When we built our Gold Medallion Home, I discovered how simple and inexpensive housekeeping can be," says Mrs. Bergeron. "Everything stays so clean. I do my own work, yet I have *more* time to enjoy my family. An all-electric home is the only really modern home."

Count the things that change for the better:

1. Flameless electric heat. "Electric heat is *even* heat—no too-hot rooms or cold ones. And no discoloration on walls and ceilings."

2. A flameless electric range. "I love to cook with electricity—you know just how long each type of food will take. And it doesn't soil my pans—I save hours of scrubbing every week."

3. A flameless electric oven. "My electric oven keeps the tasty juices *in* the meats—cooks them so tender."

4. A flameless electric dryer. "Electric drying keeps towels and sweaters fluffy as new. I even put in my 'drip drys' and they come out wrinkle-free."

5. A flameless electric water heater. "Our electric water heater operates quickly, quietly and economically." Being flameless, electric water heaters can be placed anywhere—in a closet, in a corner or under a cabinet.

WHAT IS THE GOLD MEDALLION HOME AWARD?

It is an award given only to total-electric homes that are electrically up-to-date. When a new home meets Gold Medallion Home requirements you know it offers: *clean, flameless, electric space and water heating; a clean, flameless, electric kitchen*, equipped with major appliances; plenty of "*Housepower*"—modern wiring to handle today's and tomorrow's appliances; *abundant lighting*, planned for comfort, convenience and beauty.

It costs so little to live better electrically. Why not move up to a total-electric Gold Medallion Home?

SOUTHERN CALIFORNIA Edison COMPANY

CONTRACTING & CONSTRUCTION SECTION

STATISTICS / COSTS / PROPOSED PROJECTS / NEW PRODUCTS / NEWS

LATE NEWS FLASHES

Inspectors Discuss Code Amendments

IAEI's Northwestern Section meeting at Boise was harmonious despite the fact that the twin breaker problem threatened to explode from time to time. Apparently delegates were mindful that they were working on proposed amendments of the 1959 National Electrical Code and that strife would accomplish nothing at this time. However, various flurries on the floor promise stormy sessions in the future unless a satisfactory answer to this problem is worked out. Officers presented by the nominating committee: Elden L. Shirley, president; Loran M. Christensen, first vice president; Mark Lundy, second vice president; W. L. Gaffney, secretary-treasurer. Executive committee: R. M. Countryman, James S. Backenstos, J. D. Gawne, J. Hyde Stayner, T. M. Widrig, B. A. Travis, Ray O'Leary, Edward M. Tubbs, past president. The Boise meeting and the Southwestern Section meeting at Long Beach will be reported in detail next month.

Businessmen Briefed on the Law

Basic tenets of the four laws that affect business—the Sherman, Clayton, FTC and Robinson-Patman acts — were spelled out in one of the workshop programs presented at NAED's Western region conference in San Francisco Sept. 17-20. Under the title "When to call your lawyer" K. B. DeBevoise, NAED counsel, gave concise information of value to businessmen. A session on fraud, conducted by W. E. Taylor, attorney for the Hartford Insurance group in San Francisco, and Erbon Deoventhal of Fidelity & Deposit Co., included a report on a nation-wide survey, "Why Employees Steal." Gambling, extravagant living standards, unusual family expenses, undesirable associates, inadequate income, wine, women and song were among the temptations leading to theft from employers. The conference will be reported in detail later.

(Continued on page 87)

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94 READER SERVICE SECTION

Night operation at Ranchers Cotton Oil Co. in Fresno, Calif., is facilitated by well-lighted interiors of entire open air plant

NO COTTON PICKIN' LIGHTING HERE

Cotton oil plant modernizes lighting and distribution to highest standards

Once an industrial plant management experiences definite benefits from a relighting and rewiring program it wants more of it. If the entire job cannot be done at once from a financial standpoint a real program of modernization can be set up to carry it forward by steps.

This has been the case with the Ranchers Cotton Oil Co. plant in Fresno. The installation of a highly satisfactory slimline lighting system in the linter room in August 1956 was the taste of it that led to a continuing electrical modernization program. In this both the electrical contractor and the power company are participating and cooperating.

From the original "certified lighting" job of relighting the linter room the company felt that it had derived improved morale among employees, and increased employee efficiency, resulting in improved quality of product. This came from the ability of employees to see better and make more accurate adjustments of the linter machines. No longer were they required to make such adjustments and visual inspections of chutes and feeders with a flashlight. The lighting provided good seeing and made it both easier and safer to operate and maintain. The chutes which they formerly had to climb ladders to inspect they could see from the floor. It was felt also that housekeeping had improved as a result of better illlumination and that safety had been increased measurably, particularly on the overhead catwalks.

Edward Hudson, the general superintendent, worked with Edward

Utility's service pole and disconnects and one of the substations. Note mercury unit

Left: Previous to relighting, the linter room had spotty lighting from mixture of units; high visibility from new slimline units

Franz of Snider Electric Co., the electrical contractor, and Larry Barre, power sales engineer of Pacific Gas and Electric Co., in setting up a program for the continual modernization of lighting and of the electrical distribution system at the plant.

Seven buildings or structures, comprising more than 44,000 sq ft, have been or are in the process of being rewired and relighted to present day industrial standards. In addition to the lighting a high voltage distribution system is being installed.

The plant spreads over about 34 acres, including storage areas and structures. Its power load since the original 300 kva installed in 1945 has grown to 5,000 kva. Hence it was decided that a 12-kv distribution was logical.

Primary service is taken from the PG and E 12-kv distribution circuit brought to the property line on poles. From here it is brought down to metal-clad outdoor-type 12-kv switchgear, at which it is metered, and thence underground with two 3-phase, 12-kv feeders to two load center substations located with respect to the load density on the plant site.

Each substation included a 2,500-kva, 3-phase, 12-kv/480-v transformer and necessary 480-v sub breakers and circuits to the various buildings and points of use in the yard. Lighting circuits are supplied from 120/240-v, single-phase, dry-type transformers in each buildings. All motors are operated at 480 v.

Provision has been made at the 12-kv service center to add more 12-kv feeders as load growth requires.

An important feature of the modernization program is that Superintendent Hudson and Contractor Franz agreed that all electrical equipment would be standardized. This was done to facilitate maintenance or replacement. It also makes

Old incandescent fixtures are being replaced with mercury units in all yard areas

for economy in purchasing, stocking and installation, for it is uniform in all parts of the plant. This applies to the types of lighting fixtures used as well as switches, starters, fittings, etc.

Because of the lint and oil present almost all electrical equipment is explosionproof. Lighting units in dusty locations are enclosed vaportight Day-Brite units with 48-in. rapid start lamps. In other areas open industrial-type reflectors are used with two 96-in. slimline, 430-ma lamps. The reflectors are of the slotted type with upward component for illuminating the area above as well.

In the linter rooms the certified lighting original installation, which caused the change-over of all the remainder, was designed for an average level of 45 f-c, 30 in. above floors. After 400-hour burning, readings showed 56 f-c in the aisle behind the machines and 65 f-c in the aisles in front of the machines where saws are changed and most adjustments are made.

Better lighting levels are maintained by a continual lamp maintenance program. All fixtures are cleaned once a month by a crew which makes weekly rounds of all lighting equipment to wash lamps and fixtures and relamp as necessary. Enclosed vaportight fixtures are steam hosed to remove accumulations of lint and oil.

Another vital part of the modernization program is that of replacing all outdoor incandescent area lighting units with Widelite mercury lamp units of 1,000 w each. One of these is being installed per month until the entire plant area is covered.

As new buildings are added the same standards are maintained. The contractor in rewiring has removed all the original conduit, wire and fittings and replaced it with the new standardized materials so that the entire plant will be of uniform equipment for ease of replacement or additions.

► **Re-elected to his sixth term as president** of Local 1260, International Brotherhood of Electrical Workers in Hawaii, was **Henry Rezentes.** Other officers for two-year terms are **George Lindo, vice** president; **Marie Horio,** recording secretary; **Alexander Awo,** treasurer; **Francis J. Kennedy,** business representative and financial secretary.

► **Electrical Bid Depository** of San Mateo County held its annual dinner Sept. 19 at the Villa Chartier.

Thick stone walls of Coleman Electric in Pueblo insulate for electric heating

Pueblo contractors sell electric heat by

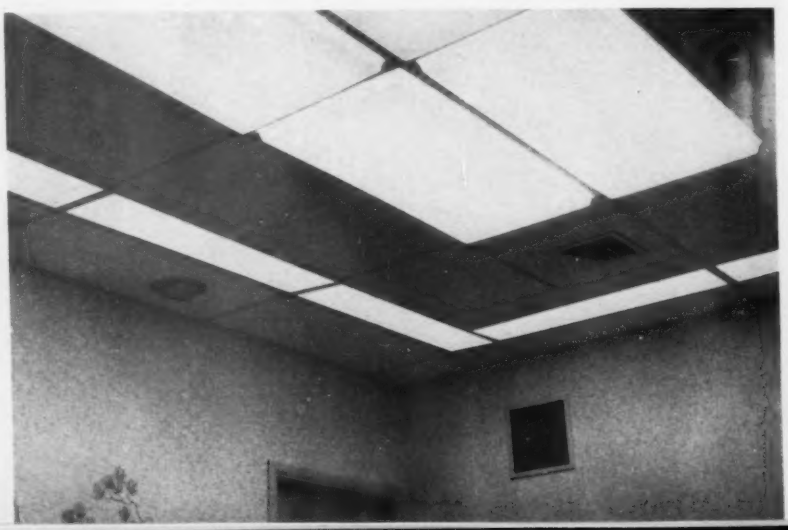
USING IT FOR

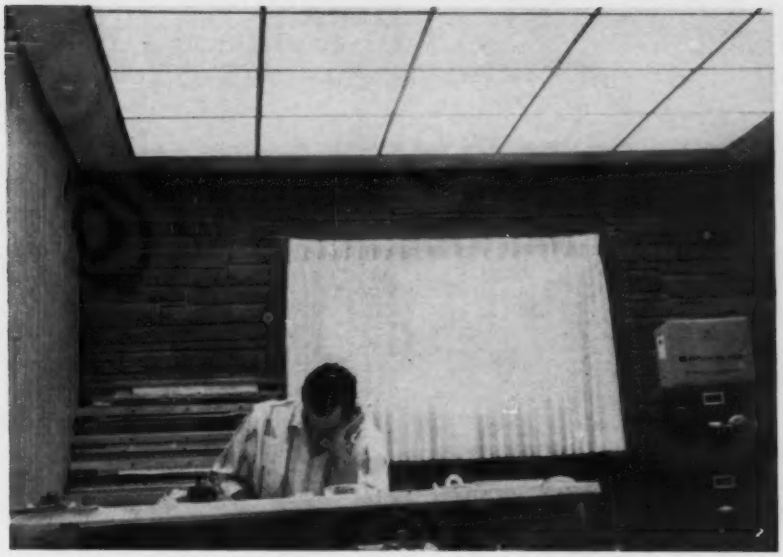
By knowing their electricity, what it will do and demonstrating it by using it completely themselves, owners of Coleman Electric Co., 1110 Lake St., Pueblo, can and do talk about it in a way to sell it to their customers. This applies not only to lighting, but to electric heating in an area where winter temperatures have previously discouraged electric heat.

Don Coleman, the son, and Earl Coleman, the father, with Don Hall, brother-in-law, own the growing business. Recently they built a new office building and shop and decided to make it an all-out demonstration of what electricity can do.

Don Coleman, a graduate in electrical engineering and a student of lighting who takes advantage of courses by the IES and NECA, worked it out that each room or area would be lighted by different means and heated, likewise, by a different method of electric heat. Hence, somewhere in the group of offices a demonstration of any equipment can be given.

Believers that insulation makes for satisfactory installation of electric heat, the solid rock walls of the old building remodeled for the offices were additionally insulated with 6 in. furred out from the rock wall. Ceiling insulation is 12 in.





Drafting room ceiling provides all heat needed because of insulation of the walls

Don Coleman varies light intensity and pattern by dimmer and low-voltage control

DEMONSTRATION

thick. Better to demonstrate lighting, all outside windows were filled in except on the street side. Inside partitions are likewise insulated, chiefly for sound. Air changes are provided through a complete duct air conditioning system which also provides for precipitation, filtering of the air and 2½ tons of refrigeration.

The heat loss from the lighting contributes a great deal to the heating. In fact, in the drafting room the 3,500 w of baseboard units have never had to be turned on regardless of how cold it was outside. With an aluminum cell louvered ceiling, lighting levels on the working plane can be obtained from 300 f-c downward.

Dimmers and low-voltage control are provided on practically all of the lighting. In the private office of Earl Coleman, for instance, valances are used on each side and some decorative fixtures as well as pin-hole spots in the ceiling. This enables them to show a variety of lighting techniques for an office.

Even the shop area is electrically lighted and heated. The stock room, painted white throughout, is one of the neatest ever seen and certainly the best lighted. It is a showplace in itself.

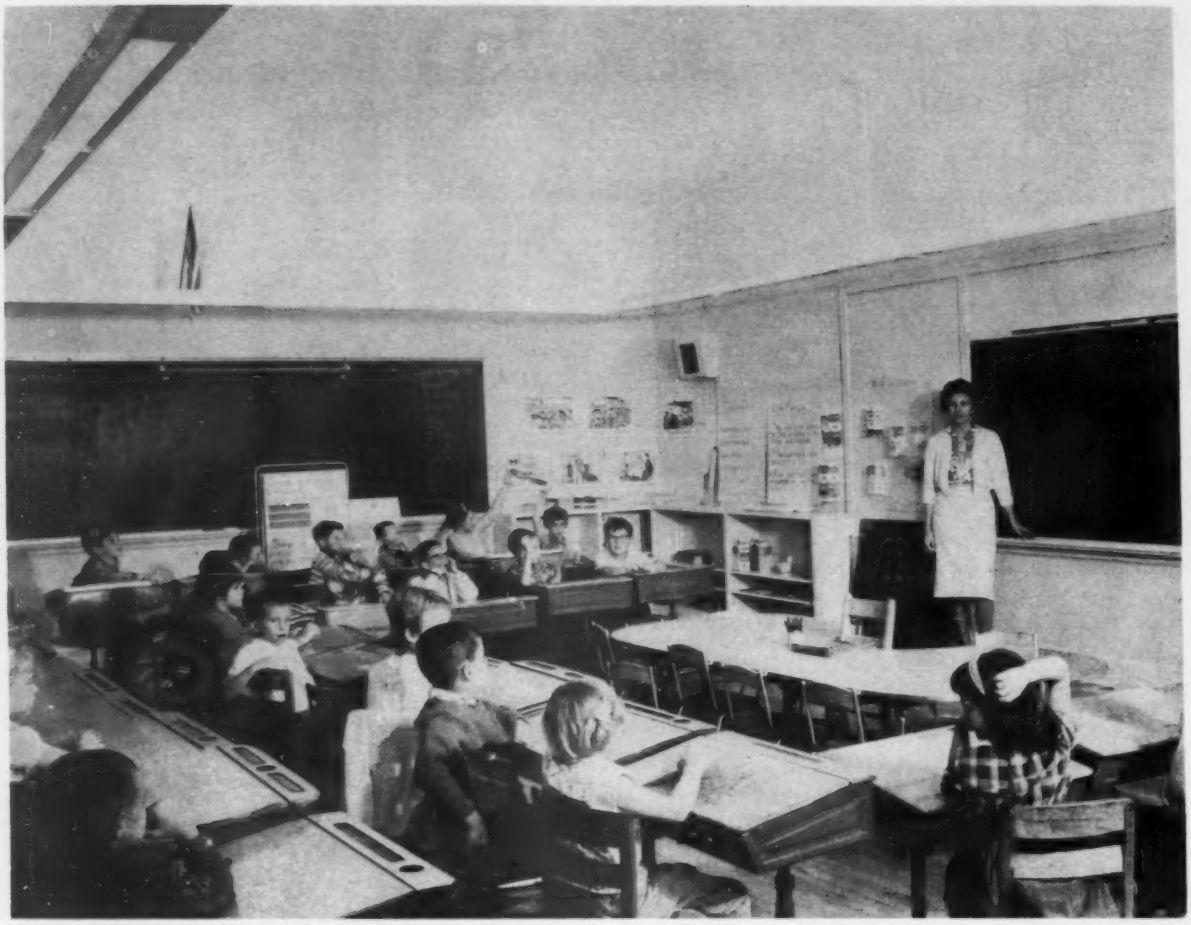
Likewise, the shop using industrial-type fixtures with the walls and ceiling painted white gives excellent reflection surface and helps to distribute the light.

As a selling gimmick, Don Coleman keeps a fixture with a bare fluorescent lamp over a work table in the shop and nearby is a prismatic lens. With this placed over the bare lamp he demonstrates the increase of illumination through control of light output at working level.

Ed Coleman's office uses and displays a variety of lighting means and controls

Reception room has baseboard heaters, periphery troffer, center panels of four faint tints of plastic, eyeball units to wash walls with light, all low-voltage controlled

Even back shop is lighted to over 100 f-c making for efficiency—and good advertising



Even distribution achieved with single high output lamps in a simple periphery fixture around the room in this Sacramento school

RING ROOM FOR RELIGHTING

BILL JONES, RESEARCH ENGINEER, SMOOT-HOLMAN CO., LOS ANGELES

Thousands of the nation's classrooms are operating under the handicap of lighting which is inadequate, both as to quantity and quality. Ten years of research into the question of adequate lighting has provided us with the levels needed for proper performance of the tasks commonly encountered in schools. Most of these tasks require an average of 63 foot-candles of glare-free illumination. Yet, the average classroom is operating on less than half this amount.

Why should this be the case? In many instances lack of knowledge of the proper levels needed, or disbelief in the benefits to be gained, are probably responsible. The major reason, however, is undoubtedly economic. With so many expenses and services to be performed, and most communities already heavily taxed, money spent to bring a lighting system up to date is hard to justify. Not only is there cost of fixtures and new lamps, but also installation costs and rewiring to accommodate the new system.

Conversion to fluorescent lighting has made it possible in many cases to reduce costs and eventually save enough to pay for the fixtures. Rewiring has still been costly, however, and usually the quality of lighting has not been too good, especially as concerns reflected glare. With the coming of the 1,500-ma series of lamps, however, it has become possible to combine the advantages of operating economy with low fixture, rewiring and installation costs. At the same time other benefits, such as vastly improved chalkboard lighting, low glare and architectural appeal, can be reaped.

Such a system was recently installed in the Arcade School in Sacramento. This system consists of single-channel, semi-indirect lighting units with a distribution of approximately 85% uplight and 15% down. The units are arranged in a rectangle round the perimeter of the room,

The exciting trend is to ELECTRIC HEATING—and the HOT LINE is AMERICAN-STANDARD "ELECTRI-WARM"!

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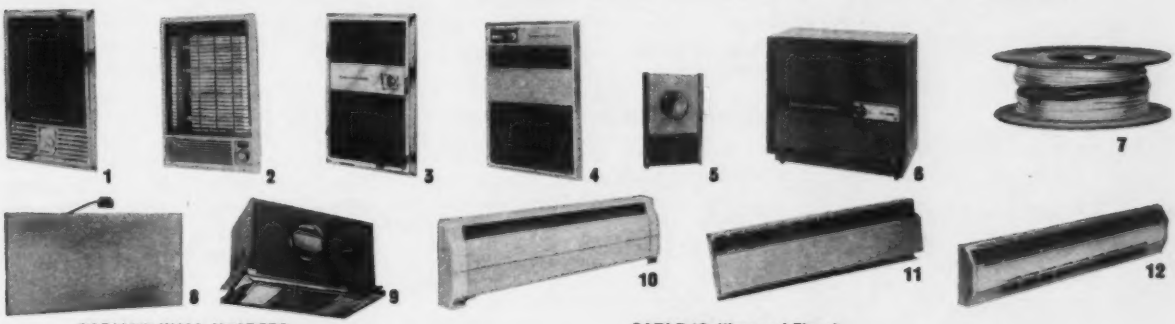

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with the ballasts mounted in line with the lamps. Only 10 lamps are required to illuminate the room to an average of 84 f-c, quite uniformly distributed. Average maintained illumination for the room will be approximately 60 f-c. Chalkboard illumination exceeds 50 f-c, eliminating any need for special chalkboard units. This last is a consequence of the perimeter arrangement, which illuminates all walls uniformly and to a high level. With conventional systems, wall lighting is poor at the ends of rows.

All brightnesses and brightness ratios are well within IES recommendations. How this can be done with so few fixtures and such wide spacing (14 ft, 8 in. row centers) is worth comment. The ceiling brightness varies over a range of less than five to one, with a maximum brightness of 160 foot-lamberts directly over the fixtures. This low ratio is due to the characteristics of the luminaire, which has an exceptionally broad upward distribution, rather similar to that of a silverbowl incandescent lamp. This is very important; a fluorescent indirect luminaire of conventional design will not give this type of performance. The fixture bottom panel brightness is controlled by a combination of diffusing panel and lens, to give as much downlight as possible without introducing either direct or reflected glare. The bottom panel brightness is 600 f-l at 0° grading down to 390 f-l at 45° and 190 f-l at 65°. This results in a reflected-brightness ratio of less than four to one, and a maximum brightness less than one-third that of a conventional system.

Ballasts Inaudible

In the past, it has been felt that 1,500-ma lamps could not be used in schools without locating the ballasts outside the room because of the noise produced. Recently, however, 1,500-ma ballasts have improved in this respect until it is now possible to obtain ballasts which are quiet enough for this use. Since only five ballasts are required for a room of this shape, as against 12 for a conventional system, the total noise can actually be less than a conventional system. In Arcade School, the ballasts were inaudible.

The lighting system alone does not determine the quality of illumination within a room. The reflectances of the room surfaces and the control of outside light also have great effect. In this school, the ceiling and upper walls were painted white; the lower walls a light (65%) green; and the floors were refinished. From the photographs it can be seen that all the room surfaces are in harmony with good practice except the chalkboards, which are scheduled for late replacement. The outside light was controlled by low-transmission glass in the lower sash of each window, and the use of preset audio-visual blinds over the upper portions.

Rewiring Costs Low

Rewiring costs were negligible. The entire system was fed from one outlet, so that only one outlet was relocated. Power consumption is about half that of the previous system. Maintenance and operating economy is such that the system is expected to pay off its initial costs in considerably less than five years.

This classroom is typical of the results that can be obtained with this system. Even greater economies can be obtained in some cases. For example, a standard 30 x 30 x 12-ft classroom, now illuminated by nine 500-w incandescent fixtures to a level of 30 f-c, can be relighted to a maintained 55 f-c by only eight lamps in this system. The room will require no rewiring; the system loads one circuit to 1,880 w; installs in less than 10 man-hours; and will pay for itself in less than three years.

Need 10-Ft Ceiling

Almost any classroom of conventional size can utilize this system, so long as its ceiling height is not less than 10 ft. Below this height it becomes difficult to obtain uniformity of illumination and good brightness ratios unless intensities of the order of 100 f-c are used. For the usual classroom, the fixture rows should be between three and seven feet from the wall. At less than three feet, the wall brightness may become too great, and at more than seven, the wall illumination may be lower than desirable.

An architectural bonus inherent in the system is the elimination of the cluttered ceiling that often results with conventional ceiling mounted or suspended units. The open construction and careful brightness balance lend a cheerful aspect that adds materially to room atmosphere.

Availability of systems of this sort makes its possible to relight these thousands of classrooms that are so far below standard. By bringing them up to date and at the same time saving money for the school districts, funds are freed for other purposes, reducing the load on the taxpayers.

LATE NEWS

Continued from page 79

► **A program centering on management problems** in apparatus shops and offices was presented to members of the EASA when they met at Charter House Hotel in Disneyland, Sept. 22 and 23, for their regional meeting. Details will be covered in a future issue.

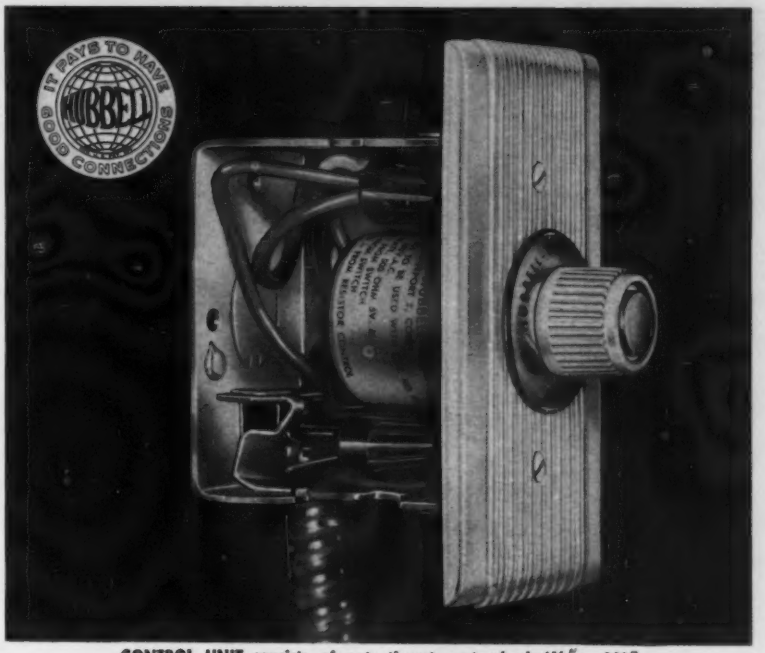
► **Walter Stone,** chief inspector of the New York Board of Fire Underwriters, will fill the position of associate editor of the *News Bulletin*. The position was held by Burney McDonald, prior to his death.

► **Chris Klawa,** chief electrical inspector of the State of Oregon, has been appointed to a new committee that has been formed to study the problem of interchangeability of circuit breakers. NEMA has indicated a willingness to help settle differences and it is hoped that a solution will be forthcoming.

► **Arizona Chapter,** International Association of Electrical Inspectors, elected its 1961-62 officers at its last meeting in Globe, Ariz. Harry Pecheco of Tombstone is chairman, James Neish of Phoenix first vice chairman, Glen Eastman of Tucson second vice chairman, C. C. Rivers of Tempe third vice chairman, with Robert Fassbender of Phoenix secretary-treasurer. A schedule of meetings was also set up. The September meeting was in Prescott, the November in Tucson, the January in Glendale, the March in Coolidge and the May 1962 in Flagstaff.

► **Robert E. Coe** has been named a vice president of Fischbach & Moore Inc., national electrical contracting firm, according to Harry F. Fischbach, president and chairman of the board. He continues as assistant general manager of the Western Division in Los Angeles, where Vice President F. S. Kellstrom is general manager of Western operations. G. H. Jastrow, controller for the Western Division, has recently been elected chairman of the Civil Service Board for the city of Burbank, a position he previously held in 1959.

► **Charles W. Henderson** has been appointed assistant to the president of Ets-Hokin & Galvin Inc., San Francisco. In this new position, Henderson will be in charge of the company's Washington office at Suite 1227, Shoreham Building.



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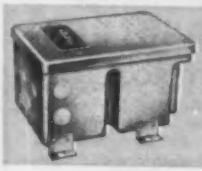

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Equipped with Padlock Hasp — Stops Current Pilferage, Tampering, Accidental Shock. 1, 2, 3-Gang Duplex Receptacle, or combination switch and receptacle.

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MANUFACTURERS AND DISTRIBUTORS

► **Aluminum Co. of America** has broken ground for a new $325,000 sales office for its San Francisco District. The 10,000-sq-ft structure will be located in Burlingame on Ogden Avenue in the Mills Estate. It will be used as a sales and distribution point for Alcoa's general products line for the area from Santa Barbara County north to the Oregon border and will replace offices in the Equitable Life Building at San Francisco. According to **Edwin M. Tatman,** district sales manager, this is the final step in an expansion and reorganization program designed to meet growing demands in the West. The program has included a new Oakland office and the opening of the Rome Cable Division office in South San Francisco's Industrial Park.

► **Graybar Electric Co.** held open house in its new building at 1211 Fee Drive, Sacramento, on Aug. 26. William White, branch manager, announced that **Wes R. Hunter** is the new operating manager, having been transferred from Graybar in Boise. **Blain R. Lind** is a new supply salesman in the area, calling on government and industrial accounts. He formerly was in San Francisco and then went to Graybar in Madison, Wis. **Allen E. Greaves** calls on the contractor trade.

► In a modern version of the Yankee Peddler, **General Electric** is sending three **Circuit Rider mobile display vans** on a tour of the United States. Each Circuit Rider is fitted with special display panels of new products from the company's circuit protective devices department in Plainville, Conn. Presentations are scheduled for distributor houses and the trucks also will be available for trade shows, jobsite calls on contractors and visits to utilities.

► **Babcock & Wilcox** has moved its southern California Tubular Products Division sales office to 94 S. Los Robles Bldg. in Pasadena. The office formerly was at 1111 Wilshire Blvd. in Los Angeles.

► **Epoxylite Corp.** has expanded its plant at 1428 N. Tyler Ave. in South El Monte, Calif. The company makes electrical waterproofing compounds, sealers and paints.

► **Smallcomb Electric Co.,** Los Angeles, specializing in ventilating and air handling electrical equipment, has purchased additional frontage adjacent to its headquarters for expansion of its electric motor repair and wholesale air conditioning and ventilating departments.

► **Douglas M. Johnson** has succeeded **Charles H. Warner** as General Electric Co.'s Pacific district manager of finance and service operation. Warner retired last month after 35 years with the company. Johnson was transferred to San Francisco earlier this year from Richland, Wash., where he was contract and accounting manager at the Hanford atomic products operation. He joined G-E in Schenectady on graduation from the University of California, and served in various accounting capacities until he was transferred to Hanford in 1953.

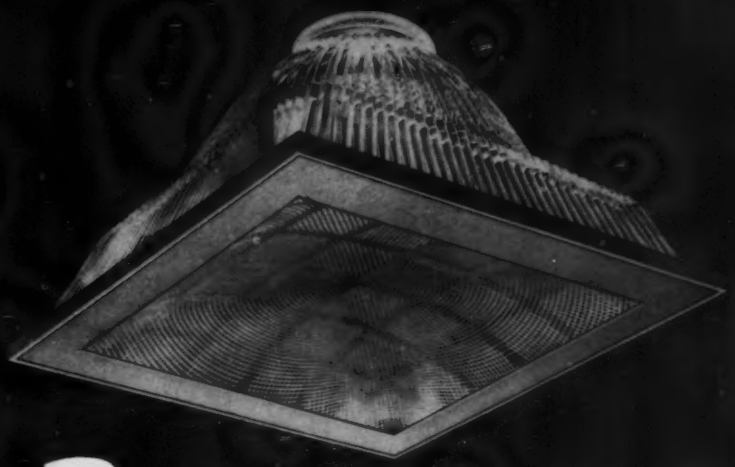
Johnson

► **Engineering Publications & Personnel** Inc. at 343 S. State St., Salt Lake City, is a new firm recently organized by Col. John J. Livingston (U.S. Army, retired), Thomas C. Smith and Robert P. Kunkel to furnish engineering personnel to the aircraft and missile industry and publish technical manuals for prime contractors for the armed forces.

► **The James R. Kearney Corp.** has announced the appointment of **T. M. Klinger** to the newly created post of manager of product sales. Klinger's responsibilities will include liaison between sales, engineering and manufacturing, coordination of product planning in line with customer needs, and field application of product services.

► **Eagle Mfg. Co.** is nearly finished with a 53,000-sq-ft plant in Los Angeles. Situated on a 10-acre site and representing an investment of $1,000,000, it will produce residential lighting fixtures, beginning in November.

► **Lynch Electric Co.** of San Francisco has diversified in an interesting manner. It has set up the California Plating Co. Inc. at 1083 American St., San Carlos, with Ira Edwards as general manager. The firm does electroplating with various metals for the components manufacturers of the San Francisco Bay area.



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Designer's Choice . . . Three prismatic lenses with different contours — "concave", "dropped trim" and "plane"—permit an unusually broad scope of design expression. Luminaires can be applied as individual tile-fitting units or as matched combinations, 2 in line or 4 square.

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Budget-Maker's Selection... Positive Automatic Latching works simply for quick, low cost relamping and servicing—push against lens to open, push against trim to close.... Glass components are easy to clean, eliminate deterioration. PAL Luminaires are economical to install and maintain.

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Larry Walker turns over his desk in the Russ Building at San Francisco to Harry P. Gough, who succeeded him as Western regional vice president, effective Sept. 15

Gough Succeeds Walker

Election of Harry P. Gough as Western regional vice president succeeding C. C. (Larry) Walker was announced by General Electric Co. on Sept. 15. Walker, who has held the post since 1955, is retiring under provisions of the company's pension plan but will remain as consultant until Nov. 1, according to Ralph J. Cordiner, board chairman and chief executive officer.

Gough joined G-E in 1929 and in 1956 was made general manager for the sales and distribution of major appliances and TV at the company's northern California district headquarters in Burlingame. In his new position his territory will include the 10-state Pacific region. Headquarters are in the Russ Building at San Francisco.

Walker was vice president and general manager of G-E's construction materials division at Bridgeport before being assigned to the Western region.

► **Automatic Switch** Co. expected to move its Los Angeles factory branch operations to larger quarters by Sept. 1, it was reported by Bernard S. K. Lau, office manager. The new address will be 5945 E. Washington Blvd.

► **Southern States Equipment** Corp. has appointed the **Matzinger-Johnson** Co. as its southern California representative. James E. Johnson and John R. Matzinger are principals in the company which is headquartered at 1329 Willow St., Los Angeles 13.

► **Fluorescent Fixtures of Hawaii** has opened headquarters at 737 Punchbowl St., Honolulu. **Stephen Herzog** is operating manager and **George Barradale** is general sales manager. The company will make fixtures and carry a complete line of lamps.

► **Floyd W. Peters** of the Westinghouse Sunnyvale Division was awarded $720 for a time-and-money-saving idea. The award, largest to a Sunnyvale Division employee so far this year, was for an improved method for belt grinding performed in turbine blade manufacture.

► **State Industries** of Los Angeles has added 110,000 sq ft to its facilities for production of steel tubing and tubular steel products. President of the firm is A. E. Haskell.

► **John L. Schroeder,** newly appointed West Central district manager for **Thomas & Betts,** will handle the company's marketing program in Denver.

► **Robert Jones,** who has been with Luminous Ceilings at Seattle was appointed president of the organization's newly formed division, Luminous Ceilings West. The new division will carry on an intensive marketing program in the 13 Western states. Jones, who since 1953 has been lighting sales representative for L. C. in the States of Washington, Montana and Alaska, will be transferred to southern California. His office will be at 5100 Santa Monica Blvd., Los Angeles.

Jones

► **A. B. Chance Co.** has announced new representatives in the West. **Clifford L. Richardson** will be line construction materials representative for the Los Angeles and San Diego area. **James Mosimann** will be electrical apparatus representative for Colorado, northern New Mexico, eastern Wyoming as well as western Kansas and Nebraska.

► **John W. Carlson Jr.** has been promoted to supervisory electrical engineer at the Wenatchee, Wash., works of Aluminum Co. of America. He formerly was rectifier engineer at Alcoa's Vancouver plant. Carlson was honored last years as Vancouver's "junior first citizen."

Fifty years ago a young draftsman named W. D. Kyle was determined to become a successful businessman. With ambition and $600 he built a company that today has 3,200 employees, and sales offices and warehouses in more than 75 of the nation's major cities. In Milwaukee, office employees heard Kyle congratulate them on the effort that has resulted in making Line Material Industries a leader in the electrical industry. The cake, presented by Fargo Mfg. Co., was later cut by Kyle and L-M President R. G. Wheaton

► Fluor Corp. has appointed **John H. Hemsarth** as general manager of its power division. Hemsarth had been for 14 years with United Engineers and Constructors of Philadelphia. Before that, he spent eight years in power engineering design and construction for RCA, the U. S. Maritime Commission, U. S. Navy Bureau of Ships and the Panama Canal Power Commission.

Hemsarth

► **John S. Payne** has been named Western regional manager for Murray Mfg. Corp. He had been a West Coast representative for 12 years, and in his new position will direct district offices and warehouses in Los Angeles, San Francisco, Portland, Denver and Phoenix. Headquarters will be in Murray's Los Angeles service center, 826 Traction Ave.

Payne

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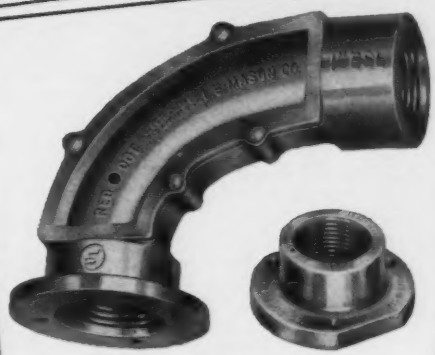
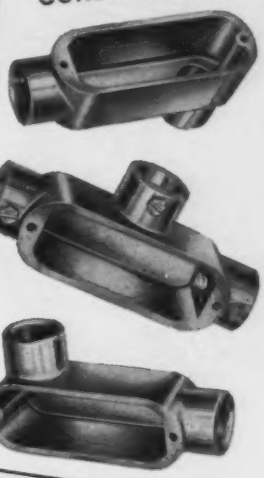
VALUE
QUALITY
PROFIT

ENTRANCE ELLS

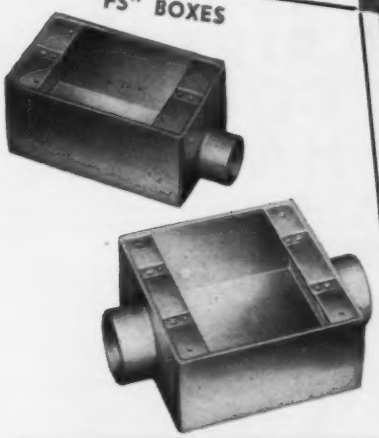


"ELECTRO - SERTS"

CONDUIT BODIES



"FS" BOXES



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► **W. J. McMillan** was appointed branch manager at Los Angeles for National Electric Division, H. K. Porter Co. He was transferred from Fresno where he had been a sales representative for the company. Before joining National Electric in 1954, McMillan was with Graybar at Minneapolis. He is past president of the Electric League of Fresno County and a member of the Fresno Chapter, IAEI.

► Yuba Manufacturing Division has appointed **William T. Egan** as general manager with headquarters at Benicia, California. Egan had been sales manager of Yuba Erectors Division in Emeryville for three years and was with Judson-Pacific Murphy Corp. before its acquisition by Yuba.

Egan

► **Motorola** Communications and Electronics has announced promotions in its Pacific Northwest sales organization. **Joseph V. Guido** is now regional sales manager, and his post as account executive for Washington and Oregon has been taken over by **D. Edward Williams.** Moving into Williams' former position as Seattle zone sales manager is **Robert H. Maki.** Guido is headquartered in Portland; Williams and Maki are in Bellevue, Wash.

► **J. Eugene McCarthy** has been named Canadian district manager for Clark Compressor Co. Ltd. with offices in Calgary. He succeeds **James D. Gilbride** who was transferred to Los Angeles as California district manager for Clark Bros. Co., division of Dresser Industries.

► **Lew Meier** has joined Brenner-Fiedler & Associates, engineering representative, as sales engineer, handling promotion. He has also been made secretary-treasurer of the corporation, President Milt Brenner announced.

► **Paul L. Chamberlain** has been appointed consulting specialist for sales at General Electric Co.'s computer department in Phoenix. The position is a newly established one.

► **J. D. Brown** is now manager of Graybar's Phoenix office, replacing **R. J. Carlson** who was transferred to the Los Angeles house.

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ANCHORS

For new construction and maintenance — Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resiliant, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

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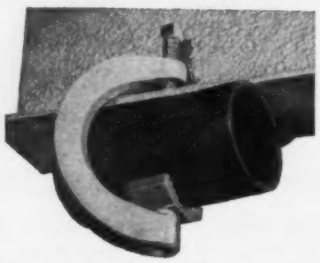
Most complete line with addition of 2 new sizes to oldest established standards in the industry.



The saddle or pipe support can be turned 360°, permitting pipe to run parallel or at right angle.

Excellent for confined areas—No drilling—no use of straps.

Made of the highest grade malleable iron, with case hardened set screw—all cadmium plated. For Aluminum, write for details.

For hanging ½" thru 2½" pipe or conduit to steel beams ⅜" thick.

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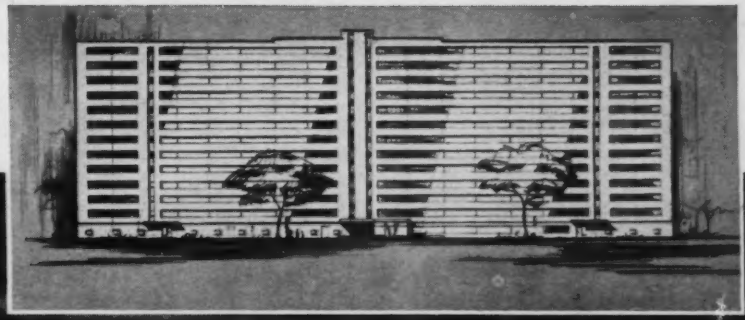
LATROBE . . . PENNSYLVANIA

Terrace Park Apartments, Cleveland's new 13-story, 254-suite apartment building features Republic Rigid Steel Conduit. Marvin Helf, Inc., developer and general contractor. M. Dolin Electric, electrical contractors. Keeva Kekst, architect.



REPUBLIC RIGID STEEL CONDUIT

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Republic Rigid is produced by Republic's famous continuous weld process to meet the most severe service requirements. Fully tested, inspected, and approved, it carries the seal of Underwriter's Laboratories, Inc.

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Compatibility and strength characterize raceways made of

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PRODUCT INFORMATION SERVICE

For fast action in securing the manufacturers' literature listed below simply circle and mail the postpaid card opposite. Use the same card to obtain more information about the new products described on the following pages. This Electrical West service is intended as an aid in keeping product files current

HEATING — Details on its Electri-Warm electric heating line are offered by American-Standard. These units are available for ceiling, wall, baseboard or floor. *Circle No. 11.*

INSULATION—American Steel & Wire is offering information on Amerzone-B butyl rubber insulated cables. Increased current-carrying capacity is claimed for Amerzone-B, which is said to withstand emergency overload copper temperatures up to 260° for short periods. *Circle No. 12.*

CLAMPS — Data folder No. 6007 from Jasper Blackburn Corp. tells how PAC clamps are made and how they reacted to tests. *Circle No. 13.*

BREAKER—The Pushmatic Pocket Guide offered by I-T-E Circuit Breaker, BullDog Electric Products Division, gives complete details on Pushmatic breakers and panels. *Circle No. 14.*

WEATHERPROOF RECEPTACLES—A complete weatherproof catalog covering its line of covers and boxes is offered by Bell Electric Co. *Circle No. 15.*

ANCHORS—Everstick Anchor Co. is offering a bulletin on its anchor line. *Circle No. 16.*

TERMINALS—New E-Z wire pressure terminals are described in literature available from Eagle Electric Mfg. Co. *Circle No. 17.*

DIMMER—The new Hubbell-trol dimmer, which operates on the saturable reactor principle, is described in a catalog page offered by Harvey Hubbell. *Circle No. 18.*

RECEPTACLES—L. E. Mason Co. is offering a new illustrated catalog of its Red Dot line. *Circle No. 19.*

PIPING—Bulletin 60B, Power and Process Piping, is offered by Midwest. For a copy of this illustrated booklet *circle No. 21.*

CABLE SUPPORTS—Catalog 858-A from P-W Industries describes that company's cable-supporting systems. Described are the type E punched bottom trays and ladder, expanded metal and solid trays. *Circle No. 22.*

METER SOCKETS—Square D describes its 200-amp heavy-duty meter sockets in bulletin SL29. These units are available in raintight, surface or semiflush mounting enclosures. *Circle No. 23.*

CLAMPS AND STRAPS—More than 600 items to fasten wire, cable, tubing and conduit are listed in a new catalog issued by Victor Specialties Inc. *Circle No. 24.*

NEW CATALOG — Pliers, climbers, belts, safety straps and other devices for the public utility field are described in a new catalog issued by Mathias Klein & Sons. For a copy of No. 103TG, *circle No. 25.*

TAP CHANGERS—Facts about Line-End load tap changers for ratings up to 230 kv and above are given by Allis-Chalmers in bulletin 01B1052. *Circle No. 26.*

BALLAST — Advance Transformer Co.'s Fluorescent Lamp Ballast Buyer's Guide, ATC-112, is available on request. *Circle No. 27.*

LUMINAIRES — Engineering data on its Pal units are offered by Holophane Co. Three prismatic lenses with different contours, concave, dropped trim and plane, are offered in this line. *Circle No. 28.*

EMERGENCY LIGHTING — Exide Industrial Marketing Division has published an illustrated technical handbook on its line of automatic battery-powered Lightguard emergency lighting equipment. The eight-page handbook includes equipment descriptions; suggested methods for providing emergency lighting in two adjacent areas, in stairwells or in several rooms; recommended wire sizes for one or two lamps at various distances from the unit in reference to two reliable methods for setting up remotely connected installations shown in schematic diagrams. A graph of a typical installation in a 70x90-ft room shows the light intensities of a single lamp at various distances. Approximate lamp illumination time is given by the various types of batteries in tabular form. This booklet, Form 6527, may be secured by *circling No. 29.*

CATALOG SHEETS—25 new pages of catalog data sheets have been prepared by Fanner Mfg. Co.'s Electrical Products Division. The new sheets, Catalog Data EP-825, give conductor and strand sizes, product lengths, strengths, weights, metals and plastics available. Specification and ordering data for the division's armor rods, line-guards, tree guards and other products are included. *Circle No. 31.*

SUSPENSION INSULATOR — How to Take Off Pounds and Lengthen Life is the title of A. B. Chance Co.'s 12-page bulletin describing the new 10-in. suspension insulator with aluminum cap and stud. According to the manufacturer, forged aluminum alloy hardware eliminates corrosion and gives about 25% saving in weight, making construction and maintenance easier. *Circle No. 32.*

CLOSED CIRCUIT TV — How closed-circuit television may be used for surveillance, transportation, observation of hazardous locations and in other ways is described in a booklet prepared by Fairbanks, Morse & Co. *Circle No. 33.*

LIGHTING EQUIPMENT — Appleton has made available new data sheets on its Quartzlite 1500, its Intenso Sportoflood line, its multipurpose Generalflood and its Mercflood. For copies *circle No. 34.*

CABLE SUPPORT—Chalfant Products Co. has prepared a 52-page booklet, No. 106, on cable support systems. Illustrations and descriptions show how each component piece becomes a part of both simple and complicated cable support installations. *Circle No. 35.*

WEDGE CLAMPS—Jasper Blackburn has published a bulletin on its wedge clamps for service cable dead-ends. Engineering and construction features are covered in detail and performance charts and ordering data are given for all sizes and types. For No. 6105 *circle No. 36.*

GUIDE—Cost, sizes, installation and other features of circuit breakers and safety switches are described by Westinghouse in a pocket comparison guide. The 32-page booklet highlights advantages of AB-I circuit breakers, including reduced cost, space and maintenance. In addition, safety, operator control, light weight, attachment and stock flexibility features are reviewed. *Circle No. 37.*

MV LAMPS — Why Lifeguard Mercury Lamps? is the title of a booklet published by Westinghouse Lamp Division. Included are facts about life and maintenance, lamp construction and a chart on lumen output of mercury vapor lamps. Types, photographs of each variety and ordering designations are given. *Circle No. 38.*

BALLASTS—Revised prices and data for General Electric's line of ballasts for fluorescent lamps are included in bulletin GEC-983Q. Included are sections on the company's new Bonus line and totally weatherproof ballasts. *Circle No. 39.*

PLASTICS FOR LIGHTING — Properties of acrylic, polystyrene and vinyl plastics determined during studies made by Holophane in evaluating plastics for luminaire lenses are given in a folder offered by that company. *Circle No. 41.*

PHOTOELECTRIC CONTROL — G-E's bulletin GEA-7230 describes the company's new simplified photoelectric control designed for any lighting application where extended time delay is not desired. *Circle No. 42.*

FLOOR BOXES—A four-page booklet on its new line of adjustable underfloor boxes and accessories for shallow and normal fill floors is offered by Thomas & Betts Co. *Circle No. 43.*

WIRING DEVICES — Economical wiring devices designed for the low-cost residential market are described and illustrated in an eight-page bulletin from the Bryant Electric Co. For C-101, *circle No. 44.*

CONDUIT — Sealtite flexible, liquid-tight wiring conduit is described in bulletin S-544 available from Anaconda Metal Hose Division. *Circle No. 45.*

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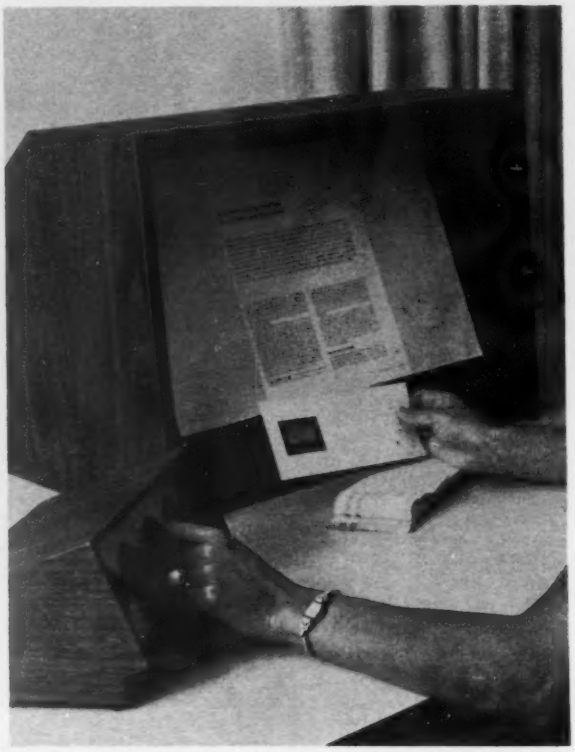
PRODUCT NEWS

New designs and applications



Each bin, above, contains 200 cells loaded with film strips from which documents may be viewed (right) without being removed

Information Dissemination

International Business Machines Corp.

IBM recently announced a new experimental application for computers to channel selected publications and other current information to the people in an organization who are most interested.

The system helps solve the acute problem of directing useful information to employees from the flood of reports, memos, magazines, books, pamphlets and other material that is being published in every commercial and technical field. A business firm or other organization could set up the system using standard electronic data processing equipment to help direct any form of printed material—from advertising material to a scientific treatise—to the people who need this information in their work.

Called Selective Dissemination of Information, the system has been operating experimentally during the past year within IBM. It has been informing 500 IBM employee subscribers about new publications prepared in the company, or received from outside sources.

The program will be made available shortly as an application for computers already in use by many types of organizations for other purposes.

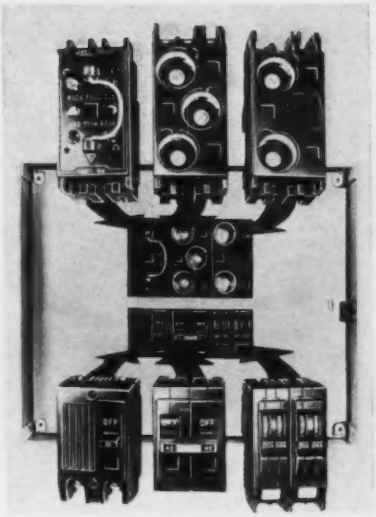
In setting up such an information system, an organization would first prepare "profiles" of the people who want to use the system. An individual's profile is a list of key words chosen by him that describe his work interests, such as "distribution," "generation," "communications," or "systems." Each individual profile is keypunched at the information center and then written on magnetic tape.

As documents or reports are received, profiles are prepared for them just as they were for the people who might be interested in them. A document profile is a list of key words that describe the document. The key words are selected, punched into IBM cards and fed into the computer.

The computer matches the profiles of the documents against the profiles of the people. When it finds an adequate match, it generates a notification card, which is sent to the person along with an abstract of the document. If the individual wishes to obtain a copy of the original document, he can request it by punching a prescored hole and returning the notification card, which then is ready for machine application. He can also indicate on the card any recent changes that have taken place in his interests.

The system operating in IBM handles nearly all information printed inside the company—such as technical reports, patent disclosures, new product announcements and manuals, company newspapers, general management information and information on contracts. It also includes technical journals received from sources outside the company. The scientists and executives subscribing to the system have found it valuable in providing technical and administrative information that they previously missed, as well as reducing the flow of unusable information across their desks.

Circle No. 46.

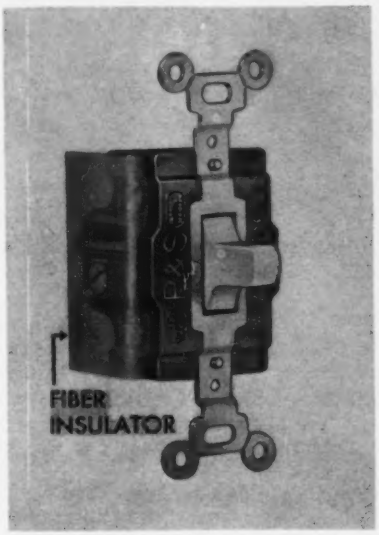


Service Entrance Panel

General Electric Co.

A new breaker/fuse panel is now available from this company's circuit protective device department. The company says it is the first time in the electrical industry that a service entrance enclosure has been fabricated that accepts both plug-in circuit breakers and plug-in fusible units.

Circle No. 47.



Maintained Contact Switch

Pass & Seymour Inc.

Designed primarily for air conditioning and heating installations, Pass & Seymour's new maintained contact a-c switches can also be used for the alternate control of any two motors, or for any applications that require heavy duty a-c double throw, center "off" switch controls.

The off position is at the center of the handle throw with the two circuits being energized at either end.

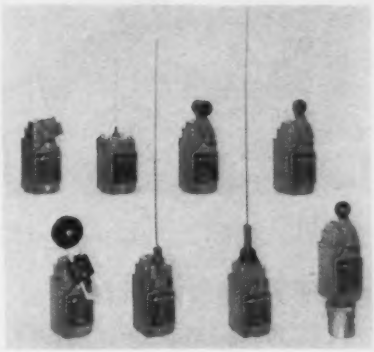
Circle No. 48.

All-Aluminum Switches

I-T-E Circuit Breaker Co.

I-T-E recently shipped the first utility order for its new TTR-6 all-aluminum switch recently introduced. The company claims the lighter weight, all aluminum bases and allied parts permit complete assembly of switch at 115 kv through 161 kv, three poles to a crate, for the first time.

Circle No. 49.



Limit Switcher

Cutler-Hammer Inc.

Cutler-Hammer has announced the addition of new operators and optional features to its line of precision oil tight limit switches that provide greater depth and flexibility of application. Eight new type switch operators are shown.

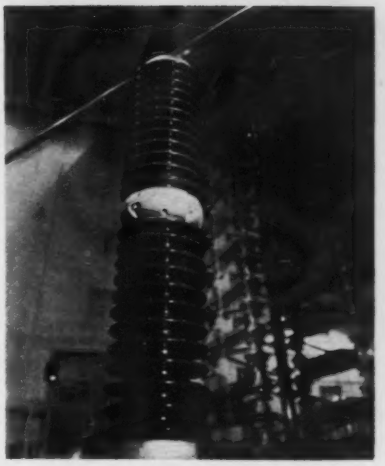
Circle No. 51.

Current Transformer

Allis-Chalmers Mfg. Co.

Redesign of its 600-v indoor-outdoor, window-type transformer for greater user convenience has been announced by Allis-Chalmers. The current transformer is now available in dual ratios of 200/400:5, 300/600:5 and 400/800:5 amp. Single ratio transformers have color coded rating plates to simplify and speed identification on a stockroom shelf or on the pole.

Circle No. 52.



Stacking Insulators

General Electric Co.

A new line of Locke stacking station post insulators featuring an exclusive metal-polymer seal that prevents air-moisture leakage has been introduced. Available in standard, high strength and extra high strength BIL ratings of 550 kv through 1,470 kv, the station post insulators are designed for uses on switches, as bus supports, etc., on system voltages of 115 kv through 345 kv.

Circle No. 53.

Time Control

Reliance Time Controls Inc.

For staggered or sequence switching of heating and regeneration loads in off-peak stored water space heating installations, a new three-circuit time switch has been developed by this company. The mechanism provides a 24-hour timing cycle and carries a stack of three dials, each with a set of on and off trippers.

Circle No. 54.

Personal Two-Way Radio

General Electric Co.

General Electric has announced a new personal portable two-way radio described as the smallest, lightest, most compact VHF-FM man-carried communications unit to be marketed to date with the transmitter and receiver in a single case. The single-case transmitter and receiver appear to meet needs of field personnel who move around considerably and find larger, heavier units cumbersome but who want more communications range and distance than pocket units currently provide.

Circle No. 55.

Turret Drive

Pitman Mfg. Co.

A new rotation mechanism for Polecat derricks and diggers has been announced by this company. The drive features a rotation gear system and hydraulic motor entirely within the turret housing so that the operator may ride in a seat mounted on the side—where he can sight along the boom in any direction, with complete visual control of the job to be done.

Circle No. 56.

Aluminum Transformer

Aluminum Co. of America

An all-aluminum power transformer has gone on line at this company's Massena, N.Y., works.

Conceived as a prototype of the standard power transformer of the future, the 20,000-kva unit was fabricated for Alcoa by General Electric Co. as part of a joint development project of the two companies. It is believed to be the largest ever built with all electrical and structural parts made of aluminum.

Circle No. 57.

Megger Insulation Tester

James G. Biddle Co.

The company announces a new instrument that replaces the Midget Megger tester. The Mark III, said to be no larger in size, includes important features not available in the original set. One great advantage claimed is that the output voltage and the reading is kept steady without the need for constant speed device or a voltage stabilizer. The new design also claims to remove all chance of damage by excess voltage.

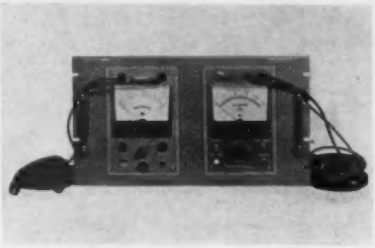
Circle No. 58.

Electric Hydraulic Actuator

Woodward Governor Co.

This company has just announced the addition of an electric hydraulic cabinet actuator to its line of mechanical hydraulic governors. The new unit is said to be the first in the company's history not employing the familar fly weights as the speed sensing elements of control. Static electrical components replace such devices as the ballhead assembly and the temporary droop dashpots normally found in mechanical hydraulic governors. Thus, a continuous control signal can be used, with particular benefit on fringe and bias control.

Circle No. 59.

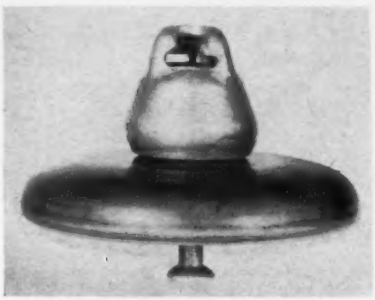


Insulation and Leakage Testor

Associated Research Inc.

Both high voltage breakdown tests and insulation leakage measurements may be made with a new model instrument recently developed by this company. The Hypot section provides a-c potential that is continuously variable from zero to 1.5 kv for breakdown testing, with separate read-out lights to indicate breakdown and leakage current above a preset value. The megohmmeter section measures insulation resistance to 50,000 megohms. Models are also available for measuring insulation resistance to five million megohms.

Circle No. 61.



Nine-Inch Suspension Insulator

Lapp Insulator Co.

Lapp has announced a new compact 9-in.-diameter suspension insulator rated at 14,000 lb combined M&E strength, and with impact rating of 55 in.-lb and electrical characteristics, for example, leakage distance, string flashover, wet, dry and impulse the same as current NEMA standards for the 15,000-lb, 10-in. insulators.

Circle No. 62.

Repeat Performance

ROYAL Portable Cords

are dependable, easy working, made right to be right on every job, time after time after time. Royal is the BIG line, too . . . rubber, neoprene and thermo-plastic, as well as lamp cords, fixture wires, machine tool wires, thermo cables, bell wires, coaxial cables, and more. All packaged for fast, easy identification and handling. So when you buy wire and cable, specify ROYAL, the line that's preferred by electrical men everywhere. See your wholesaler, or write for catalog, giving wholesaler's name.

ROYAL ELECTRIC ...an associate of LTC

ROYAL ELECTRIC CORPORATION
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Royal Electric Company (Quebec) Ltd., Pointe Claire, Quebec

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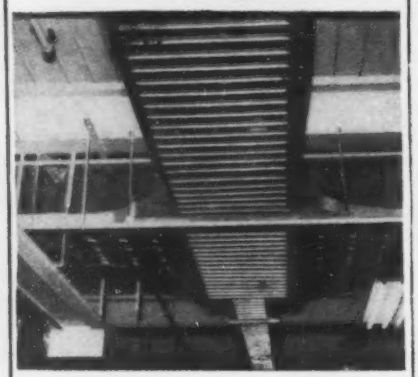
Save Time, Money Speed Installations with . . .

P-W

CABLE SUPPORTING SYSTEMS



P-W's TYPE "E" (PUNCHED BOTTOM) TRAYS—FOR POWER AND CONTROL CABLES AND INSTRUMENT TUBING—ALTHO LESS EXPENSIVE, ARE STRONGER, VERSATILE AND SUPERIOR. CONTROL CABLE CAN BE DROPPED OUT ANYWHERE.

Engineers, Contractors and Installers look for QUALITY, LONG LIFE, AND LABOR SAVINGS in their supports. That's why more and more users are turning to P-W. Among our outstanding improvements are: CONNECTIONS that are quick and easy to install—PRE-CUT SYSTEMS saving installation time—EXTENSION CONNECTORS eliminating field cutting to complete runs — ADJUSTABLE HORIZONTAL and RISER CONNECTORS to go over, under or around pipes, trusses, columns, etc. — BUILT-IN ADJUSTABLE DROP-OUT SECTIONS eliminate cutting out bottom of tray — STRAIGHT SECTIONS available in lengths up to 16' (33⅓% less connectors and less installation time over 12' lengths).

P-W SUPPORTS are available in hot dip galvanized steel or aluminum, in LADDER, EXPANDED METAL and SOLID TRAYS in addition to Type "E". All systems are interchangeable. Write for Catalog 858-A.

For the utmost in service, contact the appropriate Representative in your territory or P-W direct, regarding inquiries and placing orders.

P-W INDUSTRIES
11200 Roosevelt Blvd.
Philadelphia 15, Pa.

Proposed Western Projects

Pacific Northwest

Vancouver, B. C., School Board, school, $1,500,000.

Vancouver, Royal Bank of Canada, office, $1,000,000. Plans by Underwood, McKinley, Cameron.

Vancouver, Bank of Canada, bank, $2,000,000. Plans by Thompson, Berwick, Pratt; D. W. Thomson Co., consulting engineers; Simpson & McGregor, electrical engineers; Wiggs, Walford, Frost & Lindsay, consulting engineers.

Beale Air Force Base, Calif., U. S. Engineers, Sacramento, additions, $1,439,000.

Burlingame, College of Our Lady of Mercy, convent, $1,000,000. Plans by Frank W. Trabucco, San Francisco; Ellison, Sedgwick & Associates, San Francisco, consulting engineers.

Chino, State Div. Architecture, institute, $2,590,000.

El Cerrito, Apato Inc., apartment, health club and restaurant, $2,500,000. In care of Paul Markling & Associates, South San Francisco.

Fresno, Del Hershey Construction Co., garage, $2,000,000. Plans by Haulman, Dyer, Faller Associates Inc.

Lemorre, 12th Naval Dist., San Bruno, housing, $3,460,000.

Palo Alto, Veterans Administration, Washington, D. C., building alterations, $4,000,000. Plans by Stone, Marraccini & Patterson Inc., San Francisco.

Point Mugu, 11th Naval Dist., San Diego, launch facilities, $2,600,000.

Sacramento, U. S. Engineers, Mather Air Force Base additions, $1,852,000.

Sacramento, U. S. Engineers, McClellan Air Force Base additions, $1,465,000.

Sacramento, General Services Administration, Washington, D. C., federal bldgs., improvements, $1,059,000.

San Francisco, Franklin Hospital, hospital and office, $14 million. Plans by Stone, Marraccini & Patterson.

San Jose, First National Bank of San Jose, remodel bank, $1,200,000. In care of Melvin A. Rojko, architect, San Francisco.

Santa Clara, Kaiser Foundation, hospital, $5,295,000. Plans by Kaiser Engineers.

Sunnyvale, John B. Kilrop (Coordinated Construction Co.), store, $1,500,000. Facility Engineering Ltd., Los Angeles, engineer.

Walnut Creek, owner, apartment, $6,000,000. In care of Morrison & Howards, architects, Klamath Falls, Ore.

Yuba City, Richland Housing Authority, housing, $1,446,270. Plans by Robert S. Oliver & Associates, Marysville; Gillett-Harris & Associates, consulting engineers.

Reno, Nev., Bell of Nevada, office, $1,500,000. In care of Ferris & Erskine, architect; H. V. Lamberti, consulting engineer.

Albany, Ore., Union High School Dist., two schools, $2,000,000.

Portland, University Senior Citizens Inc., home, $3,000,000. Plans by Wolff & Zimmer.

Everett, Wash., Providence Hospital, addition, $1,500,000.

Seattle, University of Washington, addition, $1,500,000. Plans by McClure & Adkison, Spokane.

Seattle, Northgate Co., store addition, $6,000,000. Plans by John Graham & Co.

Seattle, Washington Congregational Christian Conference, housing addition, $4,000,000. Plans by Durham, Anderson & Freed.

Spokane, Desert Hotel Co., hotel, $1,000,000. Plans by W. C. Heylman.

Tacoma, Martin A. Petrich, office, store and garage, $4,000,000.

Spokane, City, airport improvements, $4,400,000. Plans by W. C. Heylman.

Yakima, St. Elizabeth Hospital, addition, $2,500,000.

Pacific Southwest

Fort Huachuca, Ariz., U. S. Engineers, Los Angeles, buildings, utilities, $2,228,000.

Tucson, Veterans Administration, Washington, D. C., building alterations, $1,000,000.

Costa Mesa., Calif., Mesa Verde Builders, dwellings, $1,155,700.

Downey, City, civic auditorium and service facilities, $2,500,000. Anthony & Langford, Whittier.

El Sorrante, Scott W. Bonds Inc., homes, $1,000,000.

Fontana, Southern California Edison, steam plant addition, $37 million. PUC permission applied for.

Hollywood, Allen E. Seigel, hotel, $9,000,000. In care of Thunderbird Hotel Corp., El Segundo; plans by Maxwell Starkman & Associates, Los Angeles.

Inyokern, 11th Naval Dist., San Diego, research bldgs., $1,000,000.

LaJolla, University of California at San Diego, science and engineer-

ing school, $1,000,000; plans by Deems-Martin & Associates, San Diego. Institute of geophysics & planetary physics, $1,000,000; plans by Ruocco & Delawie, San Diego.

Los Angeles, Board of Supervisors, garage, $5,000,000. Plans by J. E. Stanton, W. E. Stockwell, Adrian Wilson and A. C. Martin.

Los Angeles, Western Hotels Inc., hotel, $12 million. Plans by Minoru Yamasaki & Associates, Birmingham, Mich.

Miramar, 11th Naval Dist., air base construction, $1,139,000.

Newport Beach, Newport Construction Co., bldg. and garage, $3,000,000.

Pomona, Unified School Dist., schools, $1,300,000. Plans by Blurock, Ellerbrook & Associates; John A. Martin, consulting engineer, Los Angeles; Nack & Sutherland, Pasadena, mechanical engineer.

Pomona, School District, school, $1,000,000. Plans by Blurock, Ellerbroek & Associates, Corona Del Mar.

Port Hueneme, 11th Naval Dist., San Diego, housing, $3,460,000.

San Diego, Dass Construction Co., residences, $1,343,501. David Freedman, Beverly Hills, architect.

San Diego, Mercy Hospital, additions, $1,000,000. Plans by Frank L. Hope & Associates.

Santa Ana, School Dist., four-year school program, $14,915,000.

Santa Ana, Tartan Homes Inc., dwellings, $2,602,840.

Santa Monica, City, airport development, $3,000,000. Plans by Charles Luckman & Associates, Los Angeles.

Simi-Simi Valley, Unified School Dist., voted $13,403,000 bonds.

Twentynine Palms, 11th Naval Dist., San Diego, hospital addition, $1,100,000.

Victorville, California Interstate Telephone Co., headquarters bldgs., $2,500,000. Plans by Risley & Gould, Los Angeles.

Westminster, Cunningham Developers, dwellings, $2,093,920.

Whittier, Green Hills Development Inc., dwellings, $1,031,500.

Rocky Mountain

Arvada, Colo., Crestview Homes, residences, $2,250,000. In care of Stan Haertel Inc., Denver.

Denver, Sears, Roebuck & Co., store, $2,000,000. Plans by Piel, Slater, Small & Spenst.

Denver, City and County, city hall and annex, $6,000,000. Plans by Reynolds, Ward & Carey.

Denver, owner, medical office, $3,500,000. In care of Ramsey & Reeves, architects.

Denver, Title Guaranty Co., office, $1,000,000. Plans by Ralph D. Peterson & Associates.

Denver, Housing Authority, public housing, $1,750,000, plans by Miles Lantz & Co.; and $1,200,000, plans by Tician Papachristou.

Englewood, Skyline Corp., residences, $2,000,000.

Grand Lake, Shadow Mountain Lodge & Ski Club, ski complex, $2,000,000. Plans by Lloyd T. Williams & Associates, Denver.

Littleton, Noble Homes, homes, $7,000,000. In care of Darrell Shields.

Alaska and Hawaii

Anchorage, Alaska, City, telephone system expansion, $4,000,000.

Fairbanks, Independent School Dist., addition, $1,455,000.

Fairbanks, City, electrical generating facilities, $10 million.

Honolulu, Hawaii, Hilton Hotels, resort hotel, $6,000,000 - $7,000,000. Plans by Hollingsworth, Brady & Smith Associates, Long Beach, Calif.

Honolulu, City and County, school, $1,011,000. Plans by Alfred Preis & Associates.

Honolulu, G. M. Hasegawa and Heeia Development Co., homes, $1,550,000. Austin-Towill, architects.

Puzzled
about TIME SWITCHES?

ANSWER:
specify PARAGON!

See your authorized PARAGON distributor. He carries a complete stock of PARAGON Time Controls, and is able to offer you technical assistance on any application problem. Call now and find out!

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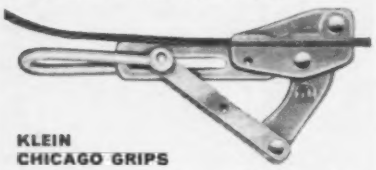
FOR THE
LONG, HARD
PULL

Whether it is a block and tackle, grips or snaps, you will find a wide variety illustrated and described in the Klein Catalog.

Klein equipment is specially designed for the tough, hard use that it receives in stringing power or communication lines. Grips, hooks, snaps are all drop-forged in Klein's own forge shop to assure maximum strength. All equipment tested to stand loads in excess of safe load indicated.



KLEIN
CHICAGO GRIPS

This family of grips suitable for bare wire, solid or strand. You will find a complete selection of grips for every type of conductor in the Klein Catalog. Jaw length and design of groove combine to eliminate conductor damage.

No. 1628-5—available with plain jaws or bronze-lined jaws. Maximum openings from .198 to .522 inch.

SELF-LOCKING BLOCK TACKLE

One of a specialty line of Klein block tackles with steel shell blocks and drop-forged hook. Rope is of highest quality Manila. Safe load, 1200 lb.

No. 1802-30 furnished with detachable hook, as shown. No. 1802-30S furnished with detachable swivel anchor hook.

SWIVEL HAND LINE SNAP

The only drop-forged snap of this type on the market. Has swivel clevis and quick-acting plunger latch. Will take ¼-inch or lighter hand lines. Safe load, 750 lbs. No. 470.

FREE TOOL GUIDE

Write for 103TG Tool Guide covering complete Klein line.

ASK YOUR SUPPLIER

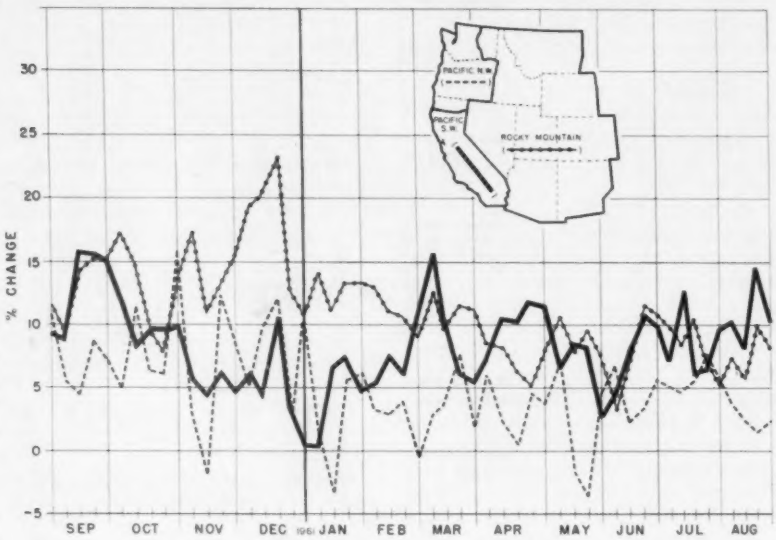
Foreign Dist: International Standard Electric Corp., N. Y.

Mathias KLEIN & Sons
Established 1857
7200 McCORMICK ROAD, CHICAGO 45, ILL.

WESTERN BUSINESS TRENDS

Output Comparisons

Year-to-Year Kwh Output Changes. Per Cent Change Over Same Week. One Year Ago for Region as Indicated in Keyed Map



Better Business—But No Boom

Here's how McGraw-Hill economists view 1962 in three areas: business investment, consumer spending and military. Business investment is expected to rise perhaps as much as 20%, giving a $7 billion boost in the area of plant and equipment purchases.

While the consumer's mood has been one of "wait and see," the outlook is bright and consumers will probably increase their expenditures for goods and service about $19 billion in the next ten months. Increase in military expenditures, growing out of the Berlin crisis, will raise defense from a fiscal 1961 figure of $46.3 billion to a fiscal 1962 figure of $52.7 billion.

In sum, the GNP is expected to reach a high of $565 billion by June 1962. Continuing increases in wages and prices and monetary inflation, however, will offset the benefits from this level of business. Many economists, mindful of the sorry flight of the "Soaring '60s," point to a period of better business but not a boom. Actually, this figure approximates a 3% growth trend from 1956.

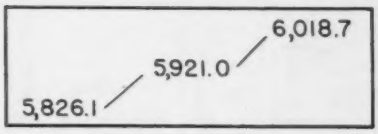
RELATIVE WHOLESALE PRICES OF ELECTRICAL MATERIAL

	Latest Month	Previous Month	Year Ago
Wire and cable	130.5	130.7	134.3
Watt-hour meters	118.6	118.6	120.9
10-hp motors	136.9	136.9	136.1
225-hp motors	176.8	176.8	229.0
Hydro generators	185.5	185.5	185.5
Steam generators	185.0	185.0	203.5
15-kva transformers	133.0	133.0	133.5
50-kva transformers	131.0	131.0	137.3
500-kva transformers	134.4	131.5	147.1
Dry-type transformers	133.7	133.7	149.6
Switch and fuse panelboards	126.0	126.0	132.4
Circuit breaker panelboards	139.2	139.2	139.1
Indoor oil circuit breakers	182.4	182.4	182.5
Outdoor oil circuit breakers	150.2	152.7	181.3

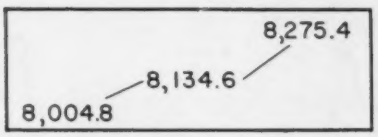
& INDICATORS

Economy at a Glance

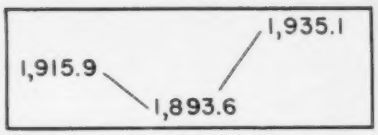
Year Ago	Month Ago	Latest Month



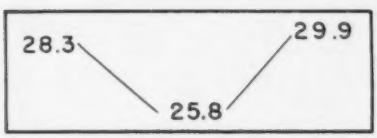
PERSONAL INCOME in millions—seasonally adjusted as of Sept. 15 (An index of consumer spending potential)



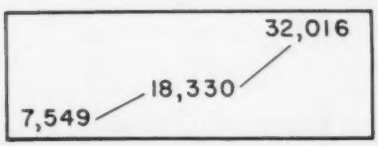
NONFARM EMPLOYMENT in thousands (Index of industrial, commercial activity)



MANUFACTURING EMPLOYMENT in thousands (A measure of manufacturing activity)



HOUSING STARTS in thousands of units (Index of new residential customers)



INDUSTRIAL BUILDING CONTRACTS in thousands of dollars (A rough index to the dollars of electrical contracting business six months to a year ahead)

► **Looking to 1962,** a McGraw-Hill *News-Record* forecast indicates that heavy construction contracts will climb 11% in 1962 to a record $25.63 billion. The publication predicts a sharp upswing for the remainder of 1961 and a preliminary forecast for 1963 at about the '62 level.

Source: McGraw-Hill Department of Economics

NEW IDEAL

"YELLOW 77"

WIRE PULLING COMPOUND

Creamy textured, yellow color, not messy, "good" smell.

- works best where the pulling is toughest—all wire sizes—including 500 MCM and larger.
- spreads out on wires in long runs—it won't quit halfway through!
- a little goes a long way.
- safe for hands and insulation, not damaged by freezing, won't dry out in the can.

EASILY APPLIED by hand, brush or cloth. Wipes off hands easily. It doesn't "wash-off" when pulling through water in conduits. Can be used to pull wires through steel, fiber or aluminum conduit. Clings around sharp bends and corners. Available in quart and gallon cans, 5-gallon pails and 55-gallon drums.

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IDEAL **For complete details, write**

IDEAL INDUSTRIES, Inc.

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Estimator's Guide

Prices shown are for new construction cost in place. Quotations furnished by LeRoy Construction Service

The figures in this guide, furnished by LeRoy Construction Service, will be kept up to date and published periodically. This guide is for your use. Will you please let the editor know if there are other figures or ideas which would make this section more valuable to you?

Residential Wiring

PER OUTLET, 120 V—2 WIRE		
Knob & tube	Each	7.50
Nonmetallic cable	Each	7.00
Armored cable (BXL)	Each	16.00
Armored Cable (BX)	Each	7.50
Flexible metallic conduit	Each	14.00
EMT	Each	18.00
Conduit rigid	Each	23.00
PER OUTLET, 230 v—3 Wire (RANGE—OVEN—WALL HEATER)		
Nonmetallic cable (Romex)	Each	14.00
Flex conduit (Greenfield)	Each	22.00
EMT	Each	23.00
SERVICE & PANEL		
Light panel & service 50 amp lugs 120/240 v—3 wire 4 1 pole circuit, 15 amp fused		70.00
Light panel & service 100 amp ACB 120/240 v—3 wire 4 1 pole circuit, 15 amp 2 2 pole circuit, 20 to 50 amp		150.00
Light panel & service 100 amp—ACB 120/240 v 6 1 pole circuit, 15 amp 3 2 pole circuit, 20 to 50 amp		165.00
Light panel & service 100 amp—ACB 120/208 v, 3 phase, 4 wire 8 1 pole circuit, 15 amp 2 2 pole circuit, 20 to 50 amp 2 3 pole circuit, 15 to 30 amp (Required for air conditioning system)		225.00
INSTALL LIGHT FIXTURES (Fixtures Purchased on Allowance)		
Incandescent	Each	4.00
Fluorescent	Each	5.00
Yard light	Each	5.00
Bathroom exhaust fan	Each	50.00
Garden pedestal light fixture	Each	40.00

Commercial Wiring—Conduit

FLEXIBLE METALLIC	Per C
½"	32.50-36.00
¾"	37.50-43.50
1"	63.00-69.00
RIGID GALVANIZED	**Per C**
½"	49.00- 54.00
¾"	62.00- 68.00
1"	79.50- 87.00
1¼"	103.00-115.00
1½"	121.50-132.00
2"	160.00-175.00
2½"	229.00-252.00
3"	296.50-325.00
3½"	365.50-401.00
4"	417.50-456.00
5"	624.50-685.00

Commercial Wiring—EMT

	Per C
½"	34.50- 38.00
¾"	43.50- 48.00
1"	58.00- 64.00
1½"	83.00- 90.00
1¼"	70.50- 76.00
2"	103.00-112.00

Commercial Wiring—RHW

WIRE 600 V—75°	Per M
750 mcm, stranded	2,011.00-2,090.00
700 mcm, stranded	1,867.00-1,940.00
600 mcm, stranded	1,675.00-1,742.00
500 mcm, stranded	1,401.00-1,457.00
400 mcm, stranded	1,140.00-1,185.00
300 mcm, stranded	923.00- 960.00
250 mcm, stranded	830.00- 860.00
No. 4/0, stranded	690.00- 717.00
No. 3/0, stranded	567.00- 589.00
No. 2/0, stranded	451.00- 965.00
No. 1/0, stranded	378.50- 393.00
No. 1, stranded	322.50- 335.00
No. 2, stranded	240.00- 249.00
No. 4, stranded	182.50- 190.00
No. 6, stranded	137.00- 142.00
No. 8, stranded	106.50- 110.00
No. 10, stranded	80.50- 83.00
No. 12, stranded	66.00- 68.00
No. 14, stranded	57.00- 59.00
No. 8, solid	99.00- 102.00
No. 10, solid	75.00- 78.00
No. 12, solid	61.00- 63.00
No. 14, solid	52.50- 54.00

Commercial Wiring—TW

WIRE 600 V—75°	Per M
750 mcm, stranded	1,850.00-1,924.00
600 mcm, stranded	1,537.00-1,598.00
500 mcm, stranded	1,300.00-1,350.00
400 mcm, stranded	1,017.00-1,057.00
300 mcm, stranded	850.00- 882.00
250 mcm, stranded	750.00- 780.00
No. 4/0, stranded	635.50- 660.00
No. 3/0, stranded	543.00- 564.00
No. 2/0, stranded	432.50- 449.00
No. 1/0, stranded	356.50- 370.00
No. 1, stranded	306.00- 318.00
No. 2, stranded	227.00- 236.00
No. 4, stranded	173.00- 179.00
No. 6, stranded	129.50- 134.00
No. 8, stranded	95.00- 98.00
No. 10, stranded	73.00- 75.00
No. 12, stranded	59.50- 61.00
No. 14, stranded	51.50- 53.00
No. 8, solid	87.00- 90.00
No. 10, solid	68.00- 70.00
No. 12, solid	55.00- 57.00
No. 14, solid	47.50- 49.00

Commercial—Outlets & Connections

Conduit and wire not included

	Each
Light fixture outlet Recess	8.00
Surface	7.00
WP	8.00
Duplex outlet 15 amp	9.00
15 amp WP	10.00
Clock outlet	9.00
Floor outlet, flush	17.00
Floor outlet, pedestal type	23.00
Outlet, 240 v, 3 wire, 1 phase, 30 to 50 amp	13.00
Outlet, 240 v, 4 wire, 3 phase, 30 to 50 amp	16.00
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Switch, double pole	10.00
Switch, 3 way	10.00
Switch, single pole w/pilot	12.00
Switch, momentary contact	10.00

Motor Outlet & Connection

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5 to 10 hp, 240 v, 3 phase	14.50
15 to 25 hp, 240 v, 3 phase	18.00
30 to 50 hp., 240 v, 3 phase	26.50
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400 amp, 3 pole, 240 v	178.00
600 amp, 3 pole, 240 v	280.00
30 amp, 3 pole, 575 v	22.00
60 amp, 3 pole, 575 v	36.00
100 amp, 3 pole, 575 v	54.00
200 amp, 3 pole, 575 v	88.00
400 amp, 3 pole, 575 v	184.00
600 amp, 3 pole, 575 v	290.00
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Three button	22.50
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Two button	27.00
Three button	34.00
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Two button	34.00
Three button	38.50
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Size 2—3 pole, 3 phase	116.00
Size 3—3 pole, 3 phase	183.00
Size 4—3 pole, 3 phase	374.00
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Duct No 4, single run, including junction boxes and misc. ftgs, etc.	Per ft 3.20
Pedestal underfloor duct outlet, power	Each 16.50
Pedestal underfloor duct outlet, telephone	Each 14.00

These prices are based on current labor rates in San Francisco. To modify for your area the following multipliers should be applied to the labor portion (your estimate) of the above figures.

Using San Francisco as	1.00
Los Angeles	1.06
San Diego	1.05
Oregon	0.90
Western Washington	0.90
Eastern Washington	0.89
Idaho	0.82
Utah	0.85
Nevada	1.02
Arizona	0.96
New Mexico	0.86
Colorado	0.89
Wyoming	0.84
Montana	0.81

"Just the way they pack it saves me 3% of the cost of the conduit."

On the job site. That's where Rome's quick-stacking strapped bundles of EMT and rigid steel conduit save you time and money.

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*Name furnished on request.

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And you can *inventory* quickly. Bundles are uniform, so counting goes very fast.

Why not get all these advantages next time you order EMT or rigid steel conduit? Just specify Rome—in quick-stacking bundles. Contact your Rome-Alcoa representative for more information. Or write to Rome Cable Division of Alcoa, Dept. 4-101, Torrance, Calif.

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For phone number of closest representative see advertising index in back of book.

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This symbol stands for QUALITY

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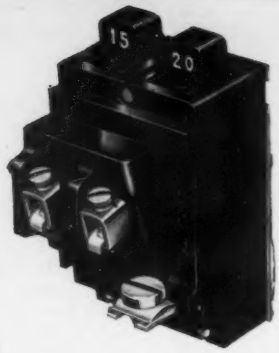
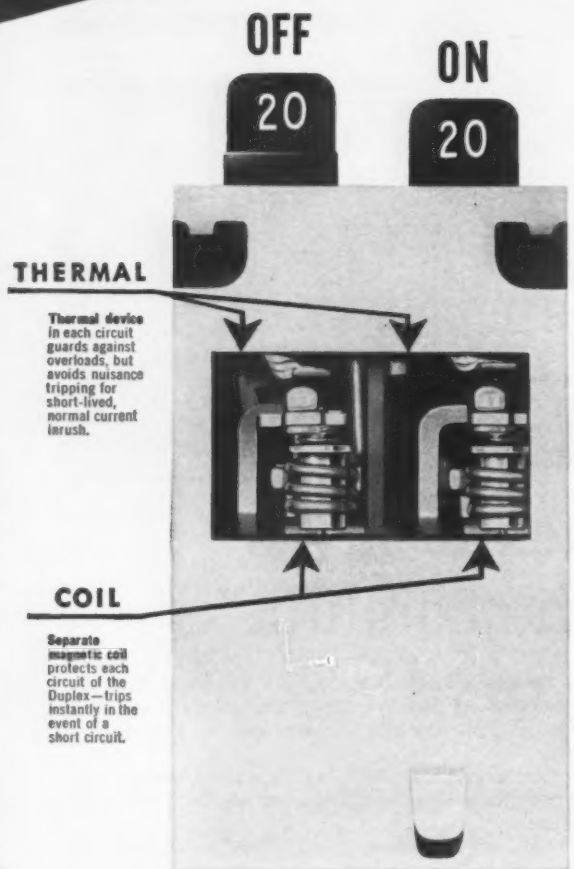
Still the leader in residential safety and convenience!




OFF
20
ON
20
THERMAL
Thermal device in each circuit guards against overloads, but avoids nuisance tripping for short-lived, normal current inrush.
COIL
Separate magnetic coil protects each circuit of the Duplex—trips instantly in the event of a short circuit.

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I-T-E CIRCUIT BREAKER COMPANY
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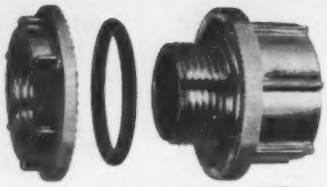

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STATEMENT REQUIRED BY THE ACT OF AUG. 24, 1912, AS AMENDED BY THE ACTS of March 3, 1933, July 2, 1946 and June 11, 1960 (74 Stat. 208) showing the ownership, management, and circulation of Electrical West, published monthly at Portland, Oregon, for October 1, 1961.

1. **The names and addresses of the publisher, editor, managing editor, and business managers are:**
Publisher, C. W. Leihy ..... 255 California St., San Francisco 11, California
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Managing Editor ..... None
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3. **The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.**

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5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: 13,065.

C. W. Leihy, Publisher

Sworn to and subscribed before me this 15th day of September, 1961.

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VERNER M. AHOLA
Notary Public residing at Seattle, Washington
(My commission expires July 24, 1964)

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San Francisco: L. A. Nott HEmlock 1-4738
Los Angeles: (Factory Sales) DUnkirk 7-2336
(Time Switches) ANgelus 8-6771
Seattle: T. R. Wood MAin 3-8204
Denver: Mt. States Machinery CHerry 4-7421
Phoenix: J. E. Redmond Co. ALpine 4-8471
Portland: R. L. Schoenberger CApitol 3-8742
Butte: R. E. McDonough Butte 2-5447
Tucson AXtel 8-4801
Albuquerque:
Gorman Engineering CHapel 7-1596
El Paso: Gorman Engineering KEystone 2-3449
Anchorage, Alaska: John P. Bagoy BR 4-1884

Southern California Edison Co. **78**
Los Angeles MAdison 4-7111

Square D Co. **110**
Los Angeles CApitol 1-1171
San Francisco JUniper 7-4590
Seattle EAst 3-1474
Portland BEImont 4-8488
Denver KEystone 4-6234
Salt Lake City DAvis 2-5859
Phoenix ALpine 8-6448
El Paso KEystone 3-0544
Spokane FAirfax 8-3690
San Diego BEImont 3-7621
Fresno AMherst 8-6268

Standard Oil Co. of Calif. **31**
San Francisco SUtter 1-7700
Los Angeles MAdison 4-2711
Portland CApitol 3-4161
Seattle MAin 3-6310
Salt Lake City DAvis 2-5831

Stearns-Rogers Mfg. Co. **20**
Denver AComa 2-8484

Subox, Inc. **17**
San Francisco: Wrathall & Krusi EXbrook 7-3593
Los Angeles: R. E. Cunningham & Son MAdison 8-1105
Portland: Wm. J. Cottrell & Assoc. CApitol 7-6191
Seattle: Fred H. Carlson Co. ATwater 4-4630
Denver: Ambler Co. TAbor 5-8885

Victor Specialties, Inc. **109**
San Francisco:
Stanley Sales Corp. UNderhill 3-8900
Los Angeles: Hayjax Co. MAdison 8-5256
Phoenix: George W. Hill WH 6-1657
Salt Lake City: John E. Eiggren AXtel 5-0472
Denver: Bacon's Elec'l Equip. CH 4-6563

Weld Rite Co. **7**
Oakland ANdover 1-3341
Los Angeles MAdison 4-9338

Bruce Emmett Co. in following cities:
Portland BEImont 2-8117
Seattle MUtual 2-6737
Spokane WA 6-6352
Salt Lake City ELgin 9-8577
Honolulu:
National Elec'l Supply Honolulu 9-2091

Westinghouse Electric Corp. **10, 11, 72, 73, 74, 75, 76, 77**
San Francisco EXbrook 2-5353
Los Angeles MAdison 6-3881
Denver KEystone 4-8121
Phoenix ALpine 8-8621
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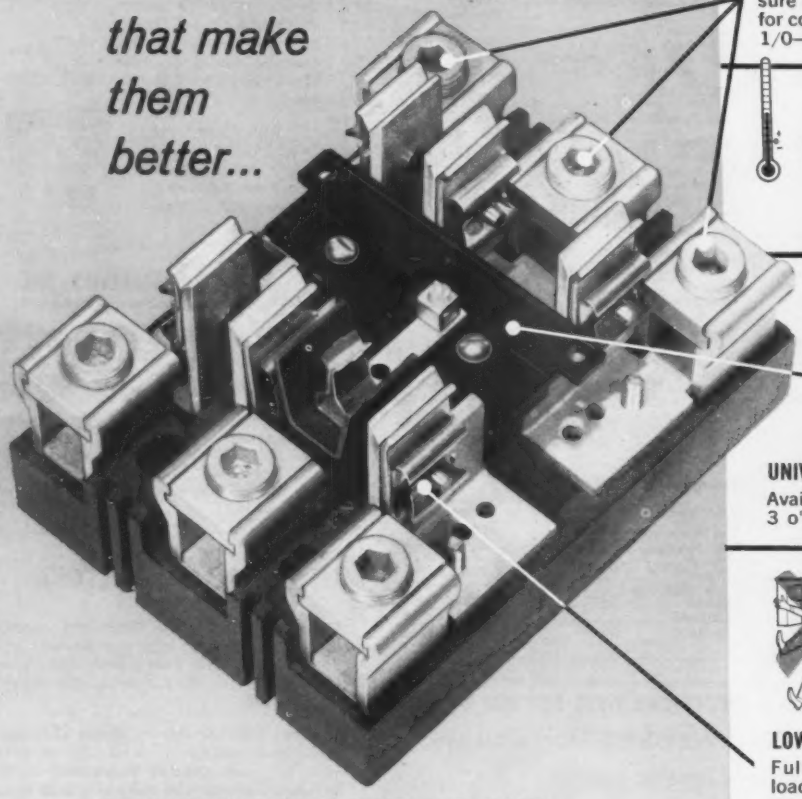

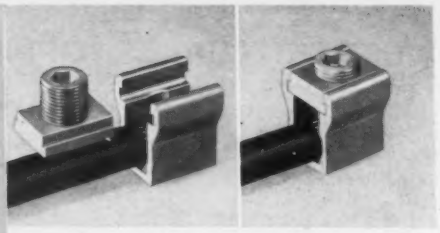

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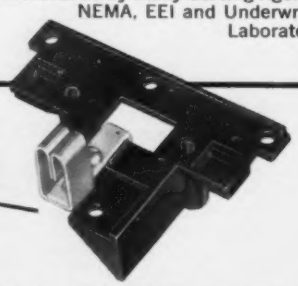

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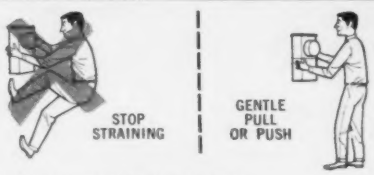

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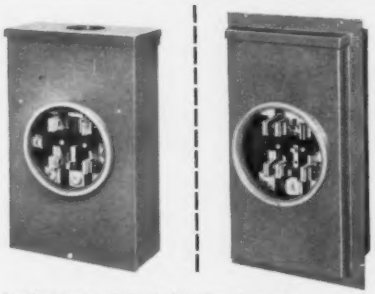

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